

Neotropical Monogenoidea. 17. *Anacanthorus* Mizelle and Price, 1965 (Dactylogyridae, Anacanthorinae) from Characoid Fishes of the Central Amazon

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ABSTRACT: The diagnosis of *Anacanthorus* Mizelle and Price, 1965, is emended and 35 new species are described from characoid fishes: *A. andersoni* sp. n., *A. carinatus* sp. n., *A. chaunophallus* sp. n., *A. chelophorus* sp. n., *A. cornutus* sp. n., *A. glyptophallus* sp. n., *A. lygophallus* sp. n., *A. nanus* sp. n., and *A. pithophallus* sp. n. from *Triportheus angulatus* (Spix); *A. calophallus* sp. n., *A. formosus* sp. n., *A. furculus* sp. n., *A. pelorophallus* sp. n., and *A. stronglyllophallus* sp. n. from *T. elongatus* (Guenther); *A. alatus* sp. n., *A. bellus* sp. n., *A. quinquaramus* sp. n., and *A. ramulosus* sp. n. from *T. albus* Cope and *T. elongatus*; *A. tricornis* sp. n. from *T. angulatus* and *T. elongatus*; *A. acuminatus* sp. n. and *A. euryphallus* sp. n. from *T. angulatus*, *T. elongatus*, and *T. albus*; *A. beleophallus* sp. n., *A. mastigophallus* sp. n., and *A. palamophallus* sp. n. from *Pristobrycon eigenmanni* (Norman); *A. xaniophallus* sp. n. from *P. eigenmanni* and *Pristobrycon* sp.; *A. catoprioni* sp. n. from *Catoprion mento* (Cuvier); *A. dipelecinus* sp. n. from *Roeboides myersi* (Gill); *A. hoplophallus* sp. n., *A. pedanophallus* sp. n., *A. spinatus* sp. n., and *A. stagmophallus* sp. n. from *Myleus rubripinnus* (Mueller and Troschel); *A. lepyrophallus* sp. n. from *Serrasalmus elongatus* Kner, *Serrasalmus* sp. (1 of Jégu), and *Serrasalmus* sp. (2n = 58); *A. periphallus* sp. n. from *Serrasalmus* sp. (2n = 58) and *Serrasalmus* sp. (1 of Jégu); *A. paraspithulatus* sp. n. from *Mylossoma duriventris* (Cuvier); and *A. stachophallus* sp. n. (syn., *Anacanthorus* sp. of Boeger and Kritsky, 1988) from *Pygocentrus nattereri* Kner. New host records for *A. jegui* Van Every and Kritsky, 1992, from *S. spilopleura* Kner, *Serrasalmus* sp. (2 of Jégu), *Serrasalmus* sp. (2n = 58), *Pristobrycon eigenmanni*, and *Pristobrycon* sp. are reported. All described species of *Anacanthorus* lack a vagina with the finding that the structure originally described as the vagina in *A. cuticulovaginus* Kritsky, Thatcher, and Kayton, 1979, is a sclerotized portion of the distal uterus. *Anacanthorus spathulatus* Kritsky, Thatcher, and Kayton, 1979, is chosen from multiple original spellings as the correct spelling for the species.

KEY WORDS: Brazil, taxonomy, Monogenoidea, Dactylogyridae, Anacanthorinae, *Anacanthorus*, *Anacanthorus jegui*, *Anacanthorus cuticulovaginus*, *Anacanthorus spathulatus*, *Anacanthorus acuminatus* sp. n., *Anacanthorus alatus* sp. n., *Anacanthorus andersoni* sp. n., *Anacanthorus beleophallus* sp. n., *Anacanthorus bellus* sp. n., *Anacanthorus calophallus* sp. n., *Anacanthorus carinatus* sp. n., *Anacanthorus catoprioni* sp. n., *Anacanthorus chaunophallus* sp. n., *Anacanthorus chelophorus* sp. n., *Anacanthorus cornutus* sp. n., *Anacanthorus dipelecinus* sp. n., *Anacanthorus euryphallus* sp. n., *Anacanthorus formosus* sp. n., *Anacanthorus furculus* sp. n., *Anacanthorus glyptophallus* sp. n., *Anacanthorus hoplophallus* sp. n., *Anacanthorus lepyrophallus* sp. n., *Anacanthorus lygophallus* sp. n., *Anacanthorus mastigophallus* sp. n., *Anacanthorus nanus* sp. n., *Anacanthorus palamophallus* sp. n., *Anacanthorus paraspithulatus* sp. n., *Anacanthorus pedanophallus* sp. n., *Anacanthorus pelorophallus* sp. n., *Anacanthorus periphallus* sp. n., *Anacanthorus pithophallus* sp. n., *Anacanthorus quinquaramus* sp. n., *Anacanthorus ramulosus* sp. n., *Anacanthorus spinatus* sp. n., *Anacanthorus stachophallus* sp. n., *Anacanthorus stagmophallus* sp. n., *Anacanthorus stronglyllophallus* sp. n., *Anacanthorus tricornis* sp. n., *Anacanthorus xaniophallus* sp. n., *Triportheus angulatus*, *Triportheus elongatus*, *Triportheus albus*, *Pristobrycon eigenmanni*, *Pristobrycon* sp., *Catoprion mento*, *Roeboides myersi*, *Myleus rubripinnus*, *Serrasalmus spilopleura*, *Serrasalmus elongatus*, *Serrasalmus* sp., *Mylossoma duriventris*, *Pygocentrus nattereri*.

Anacanthorus was proposed by Mizelle and Price (1965) for 3 species from the gills of the red-breasted piranha, *Pygocentrus nattereri* Kner (formerly *Serrasalmus nattereri*). The genus was included in the Ancyrocephalinae (Dactylogyridae) and characterized by monogenoideans lacking anchors and possessing 7 pairs of haptorial hooks and 2 pairs (1 dorsal, 1 ventral) of 4A's. Price (1967) proposed the Anacanthorinae (Dac-

tylogyridae) for the genus based primarily on the original generic characters. The Anacanthorinae was accepted by Kritsky and Thatcher (1976) who added the monotypic *Anacanthoroides* and a third diagnostic feature to define the subfamily, i.e., presence of a modified distal uterus.

At present, 62 species of *Anacanthorus*, including those of this and the following paper, have been described (see Appendix in Van Every

and Kritsky, 1992). These species apparently form a monophyletic subgroup of Dactylogyridae (see Kritsky and Boeger, 1989), parasitic exclusively on characoid fishes (Cypriniformes) from the Neotropical Region. Individual species of *Anacanthorus* show varying ability to infest closely related host species. Further, subgroups within *Anacanthorus*, based on general morphology of the copulatory complex, appear to express high host specificity to familial groups within the Characoidea. Because of these traits, species of *Anacanthorus* may provide valuable models for study of phylogeny, coevolution, and biogeography. The purpose of this study was to provide descriptions of new species so that the latter would be available for phylogenetic and coevolutionary analysis (e.g., Van Every and Kritsky, 1992).

Materials and Methods

Fish hosts were collected by hook-and-line, seine, or throw net from locations in the central Amazon during 1979–1989. Methods of parasite collection, preparation of helminths for study, measurement, and illustration are those of Kritsky et al. (1986). Measurements, all in micrometers, represent straight-line distances between extreme points and are expressed as a mean followed by the range and number of specimens measured in parentheses; body length includes that of the haptor. Numbering of hook pairs follows that recommended by Mizelle (1936) (see Mizelle and Price, 1963). Type and voucher specimens are deposited in the helminth collections of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA); the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (IOC); the U.S. National Museum, Beltsville, Maryland (USNM); the University of Nebraska State Museum, Lincoln, Nebraska (HWML); and the Zoological Institute, U.S.S.R. Academy of Sciences, Leningrad (ZIAC), as indicated in the respective descriptions. Museum numbers have not been received from IOC and ZIAC for publication. For comparative purposes, the following specimens were examined: Holotype, *Anacanthorus anacanthorus* Mizelle and Price, 1965 (USNM 60459); holotype, *A. brasiliensis* Mizelle and Price, 1965 (USNM 60460); holotype, 9 paratypes, *A. cuticulovaginus* Kritsky and Thatcher, 1974 (USNM 72837, 74021); holotype, 9 paratypes, *A. jegui* Van Every and Kritsky, 1992 (INPA PA338, USNM 81751, HWML 33383); holotype, *A. neotropicalis* Mizelle and Price, 1965 (USNM 60461); 17 vouchers, *A. spathulatus* Kritsky, Thatcher, and Kayton, 1979 (USNM 81798); 4 vouchers, *Anacanthorus* sp. of Boeger and Kritsky (1988) (= *A. stachophallus* sp. n.) (USNM 79197, HWML 23371).

Some hosts have been provisionally identified as *Serrasalmus* sp. (1 of Jégu), *Serrasalmus* sp. (2 of Jégu), *Serrasalmus* sp. (2n = 58), and *Pristobrycon* sp. by M. Jégu, ORSTOM, INPA, Manaus, Amazonas, Brazil, and may represent undescribed species. Specimens of each undescribed form are available through the ichthyology collection, INPA, Manaus, Amazonas, Brazil.

Results

Anacanthorus Mizelle and Price, 1965

EMENDED DIAGNOSIS: Dactylogyridae, Anacanthorinae (see Kritsky and Boeger, 1989). Body fusiform, divisible into cephalic region, trunk, peduncle, haptor. Tegument thin, smooth; peduncular region may be corrugated. Four cephalic lobes, 2 terminal, 2 bilateral; head organs present; cephalic glands comprising 2 bilateral groups of cells lying posterolateral, dorsal to pharynx. Eyes present. Pharynx muscular, glandular; esophagus present; intestinal ceca 2, confluent posterior to testis, lacking diverticula. Gonads tandem or slightly overlapping, intercecal; common genital pore midventral. Testis post-ovarian; vas deferens expanding into fusiform seminal vesicle, with anterior loop prior to entry into cirral base, looping left cecum or not. Sclerotized cirrus present; accessory piece present or absent. Ovary near midlength; oviduct short; uterus well developed, with terminal region consisting of variably sclerotized, thickened internal wall; vagina absent. Two bilateral bands of vitellaria coextensive with intestinal ceca; vitelline commissure anterior to ovary, ventral. Haptor bilobed, armed with 7 pairs (4 ventral, 3 dorsal) of hooks, 2 pairs (1 dorsal, 1 ventral) of 4A's. Anchors, bars absent. Parasites of Neotropical characoid fishes.

TYPE SPECIES: *Anacanthorus anacanthorus* Mizelle and Price, 1965.

TYPE HOST: *Pygocentrus nattereri* Kner, Serrasalminae.

REMARKS: General body features of *Anacanthorus* species are provided in the whole-mount illustrations by Van Every and Kritsky (1992; Figs. 2–9, 38–42). Available diagnoses of *Anacanthorus* do not include a description of the course of the vas deferens in relation to the intestinal ceca (Mizelle and Price, 1965; Kritsky et al., 1979). However, descriptions of *Anacanthorus* species have been provided in which the vas deferens was not mentioned (Mizelle and Price, 1965; Mizelle and Kritsky, 1969), in which the vas deferens was suggested to loop the left intestinal cecum (Kritsky et al., 1979; Boeger and Kritsky, 1988), and in which clear indication of it looping the left cecum is provided (Kritsky and Thatcher, 1974; Kritsky et al., 1979; Boeger and Kritsky, 1988). Further, Van Every and Kritsky (1992) suggest that the vas deferens does not loop the intestinal cecum in 13 species of *Anacanthorus* infesting Serrasalminae in Brazil, and we could

not determine with confidence the course of the vas deferens in any of the 36 species of *Anacanthorus* studied herein. From new slide preparations, we confirm that the vas deferens does not loop the intestine in *A. spathulatus* Kritsky, Thatcher, and Kayton, 1979, although a sinistral loop of the duct occurs ventral to the left cecum immediately proximal to the seminal vesicle. Although the course of the vas deferens may be diagnostic at the generic level, this character will have limited value until its states are determined in all *Anacanthorus* species. Thus, we recognize *Anacanthorus* for Neotropical species characterized by 1) possessing a bilobed hapter armed with 7 pairs of hooks and 2 pairs (1 dorsal, 1 ventral) of 4A's, 2) having tandem or slightly overlapping gonads (testis postovarian), 3) lacking a vagina, haptoral anchors, and bars, and 4) having a modified (thickened or sclerotized) distal uterine wall.

Anacanthorus cuticulovaginus Kritsky and Thatcher, 1974, is the only species in the genus reported to possess a vagina. However, our examination of the type specimens of this species has confirmed that the structure described as the vagina by the original authors is a sclerotized portion of the distal uterus similar to what we report in *A. quinqueramus* sp. n. While *cuticulovaginus* becomes an "inappropriate name" sensu the ICZN Art. 18, which cannot be rejected, these findings suggest that the absence of a vagina is also diagnostic for the genus.

Kritsky et al. (1979) described *Anacanthorus spathulatus* from the environs of Manaus, Amazonas, Brazil. In their paper, which the authors did not have an opportunity to review in galley, the specific name occurs in 2 forms. Correspondence in Kritsky's files and type specimen museum labels both clearly indicate that *spathulatus* was intended for this species.

***Anacanthorus acuminatus* sp. n.**

(Figs. 1–3)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORDS: *Triportheus elongatus* (Guenther), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989) and Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (6 January 1989); *T. albus* Cope, Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA347;

paratypes, USNM 81662, 81663, 81664, 81665, HWML 33340.

DESCRIPTION (based on 14 specimens): Body 239 (150–310; $N = 10$) long, robust, fusiform, tapered toward both ends from level of ovary or body midlength; greatest width 66 (54–78; $N = 10$). Cephalic lobes large, well developed; anterior lobes fused along midline. Two eyes; granules variable, usually moderate in size, subovate; few accessory granules scattered in cephalic, anterior trunk regions of adults, numerous throughout body in young specimens. Pharynx subspherical, 15 (13–17; $N = 9$) in diameter. Haptor 38 (26–52; $N = 10$) long, 52 (48–59; $N = 10$) wide. Hooks similar; each with truncate slightly depressed thumb, slightly expanded shank with small proximal enlargement; hook 17–18 ($N = 19$) long; filamentous hooklet (FH) loop about 0.5 shank length. 4A's similar, each 7–8 ($N = 4$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 28 (23–32; $N = 4$) long, 21 (16–25; $N = 4$) wide; ovary 33 (26–41; $N = 5$) long, 22 (15–25; $N = 5$) wide. Cirrus, accessory piece articulated by copulatory ligament 4 (3–6; $N = 13$) long. Cirrus 34 (30–37; $N = 13$) long, sigmoid, with base lacking flange. Accessory piece 25 (23–28; $N = 14$) long, with short basal, 3 distal branches; 2 distal branches acuminate.

REMARKS: *Anacanthorus acuminatus* may be confused with *A. glyptophallus* sp. n. but lacks the second accessory piece and a cork-screw portion of the vas deferens distal to the seminal vesicle characteristic of the latter species. The specific name is from Latin (*acuminatus* = taper-pointed) and refers to the distal branches of the accessory piece.

***Anacanthorus alatus* sp. n.**

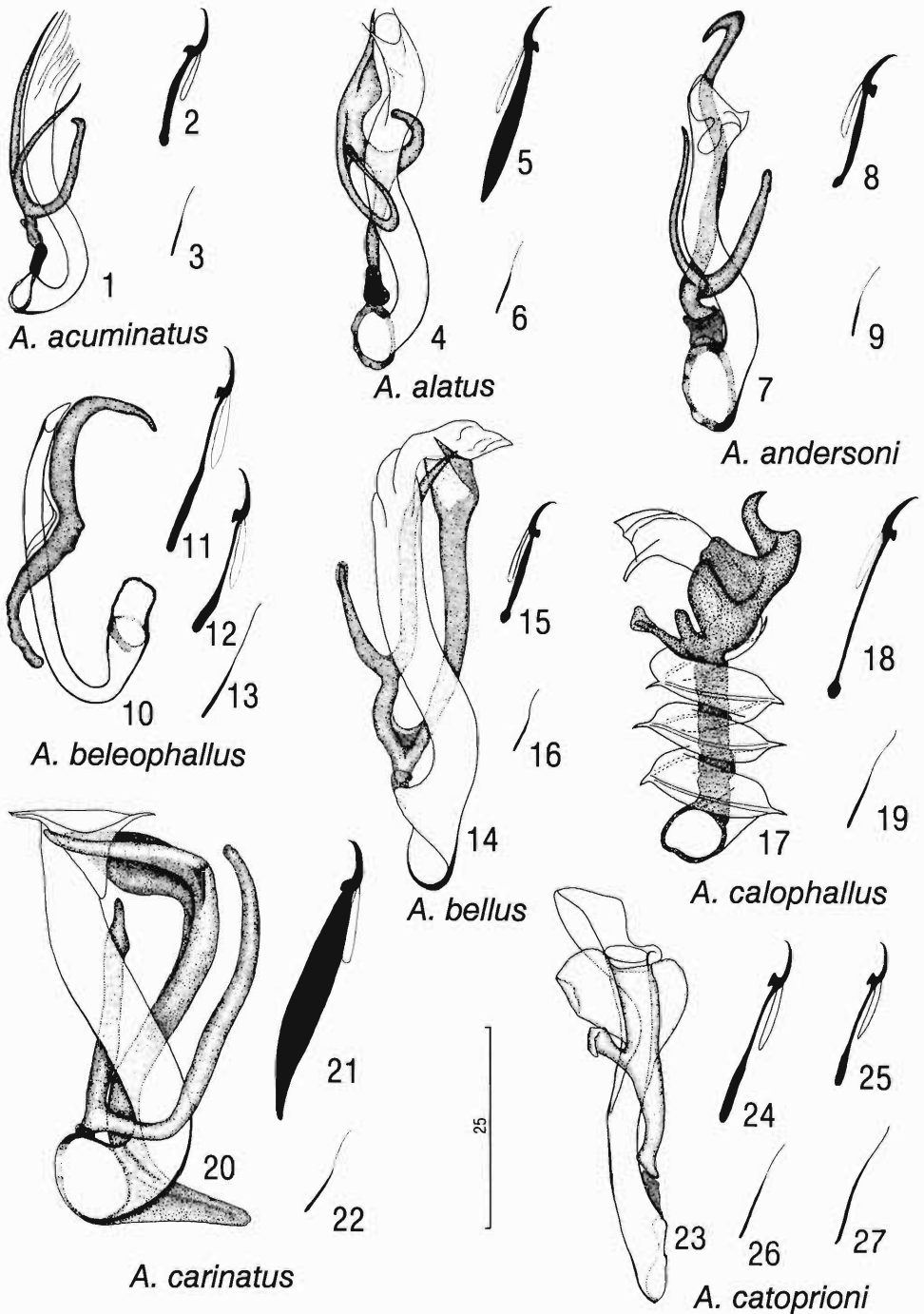
(Figs. 4–6)

TYPE HOST AND LOCALITY: *Triportheus albus* Cope; Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORD: *Triportheus elongatus* (Guenther), Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (6 January 1989).

TYPE SPECIMENS: Holotype, INPA PA348; paratypes, USNM 81666, 81667, HWML 33341.

DESCRIPTION (based on 6 specimens): Body 316 (261–356; $N = 4$) long, robust, fusiform, tapered posteriorly from level of gonads; greatest width 93 (81–113; $N = 4$) in anterior trunk. Ce-



Figures 1–27. Sclerotized parts of *Anacanthorus* spp. 1–3. *Anacanthorus acuminatus*. 1. Copulatory complex. 2. Hook. 3. 4A. 4–6. *Anacanthorus alatus*. 4. Copulatory complex. 5. Hook. 6. 4A. 7–9. *Anacanthorus andersoni*. 7. Copulatory complex. 8. Hook. 9. 4A. 10–13. *Anacanthorus beleophallus*. 10. Copulatory complex. 11. Hook pairs 3, 4. 12. Hook pairs 1, 2. 5–7. 13. 4A. 14–16. *Anacanthorus bellus*. 14. Copulatory complex. 15. Hook. 16. 4A. 17–19. *Anacanthorus calophallus*. 17. Copulatory complex. 18. Hook. 19. 4A. 20–22. *Anacanthorus carinatus*. 20. Copulatory complex. 21. Hook. 22. 4A. 23–27. *Anacanthorus catoprioni*. 23. Copulatory complex. 24. Hook pairs 3, 4. 25. Hook pairs 1, 2. 5–7. 26. 4A (ventral). 27. 4A (dorsal). All figures are drawn to the 25- μ m scale.

phalic lobes large, well developed; anterior lobes fused along midline. Four eyes equidistant; members of anterior pair absent or poorly developed, smaller than those of posterior pair; granules small, variable in shape; accessory granules absent or few in cephalic, anterior trunk regions. Pharynx subspherical, 26 (24–28; $N = 4$) in diameter. Haptor 51 (45–57; $N = 4$) long, 64 (62–68; $N = 4$) wide. Hooks similar; each with truncate slightly depressed thumb, conspicuously expanded shank gently tapered toward both ends; hook pairs 1–6: 26 (25–28; $N = 16$), pair 7: 31 (30–32; $N = 6$) long; FH loop about 0.5 shank length. 4A's similar; each 10 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 33–34 ($N = 2$) long, 28 (24–33; $N = 2$) wide; ovary 28 ($N = 1$) long, 30 ($N = 1$) wide. Cirrus, accessory piece articulated by copulatory ligament 5–6 ($N = 5$) long. Cirrus 50 (47–54; $N = 5$) long, sigmoid, with slight terminal flare, base lacking flange. Accessory piece 40 (36–43; $N = 5$) long, with long basal, 3 distal branches; medial distal branch looping posteriorly; distal branch comprising 2 acute lobes.

REMARKS: A single specimen of *Anacanthorus alatus* was recovered from *Triportheus elongatus*. This worm did not differ in morphology of the copulatory complex or haptoral armament from those taken from *T. albus*. However, hooks of the specimen from *T. elongatus* were slightly larger (pairs 1–6: 33 [32–34; $N = 4$], pair 7: 38 [$N = 2$]).

Anacanthorus alatus resembles *A. cornutus* and *A. lygophallus* spp. n. based on morphology of the hooks and accessory piece. These species differ by the distal branch of the accessory piece in *A. alatus* apparently representing a fusion of 2 branches (branches are clearly separated in *A. cornutus* or single in *A. lygophallus*). The specific name is from Latin (*alatus* = winged) and refers to the distal branch of the accessory piece.

***Anacanthorus andersoni* sp. n.**
(Figs. 7–9)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA349; paratypes, USNM 81668, HWML 33342.

DESCRIPTION (based on 4 specimens): Body 421 (355–460; $N = 3$) long, robust, with irregular margins; greatest width 194 (177–222; $N = 3$) in

anterior trunk. Cephalic lobes large, well developed; terminal lobes confluent. Four eyes; members of posterior pair larger, slightly closer together than those of anterior pair; granules small, subspherical to ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subovate, greatest width 28 (24–32; $N = 3$). Haptor 59 (57–62; $N = 3$) long, 90 (80–100; $N = 3$) wide. Hooks similar; each with truncate slightly depressed thumb, slightly expanded shank with small proximal enlargement; hook pairs 19–20 ($N = 9$) long; FH loop about 0.5 shank length. 4A's similar; each 8–9 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 56 (43–70; $N = 2$) long, 37 (27–48; $N = 2$) wide; ovary 72 (68–77; $N = 3$) long, 55 (49–61; $N = 3$) wide. Cirrus, accessory piece articulated by copulatory ligament 5–6 ($N = 4$) long. Cirrus 44 (35–59; $N = 4$) long, sigmoid, with terminal flare, large base lacking flange. Accessory piece 36 (32–39; $N = 3$) long, with short basal, 3 distal branches; longest distal branch terminally recurved; slender lateral branch with sigmoid origin.

REMARKS: This species is similar to *Anacanthorus chaunophallus* sp. n. but differs from it by having slightly expanded hook shanks and an elongate recurved primary branch of the accessory piece (reduced in *A. chaunophallus*). The remaining 2 branches of the accessory piece in *A. andersoni* are comparatively shorter than those of *A. chaunophallus*. This species is named for Dr. Robert C. Anderson, Idaho State University, in appreciation of his assistance during field excursions.

***Anacanthorus beleophallus* sp. n.**
(Figs. 10–13)

TYPE HOST AND LOCALITY: *Pristobrycon eigenmanni* (Norman); Rio Negro near Manaus, Amazonas, Brazil (28 December 1988).

TYPE SPECIMENS: Holotype, INPA PA350; paratypes, USNM 81669, HWML 33343.

DESCRIPTION (based on 5 specimens): Body 352 (289–389; $N = 3$) long, fusiform, tapered toward each end from midlength; greatest width 82 (53–113; $N = 3$). Cephalic lobes poorly developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules small, ovate to elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 22 ($N = 1$) in diameter. Haptor 60 (56–64; $N = 3$) long, 65 (57–

71; $N = 3$) wide. Hooks similar; each with truncate slightly depressed thumb, variable proximal enlargement of shank; hook pairs 1, 2, 5, 7: 23 (21–26; $N = 12$), pairs 3, 4, 6: 26 (24–28; $N = 9$) long; FH loop about 0.5 shank length. 4A's similar, each 14–15 ($N = 3$) long, proximally expanded about 0.5 length. Gonads indistinct. Cirrus, accessory piece nonarticulated. Cirrus 38 (36–40; $N = 5$) long, J- or C-shaped, with submedial fold on shaft, base with flange. Accessory piece 37 (35–39; $N = 5$) long, with sickle-shaped distal tip; submedial (muscle) articulation point (see Van Every and Kritsky, 1992) slightly elevated.

REMARKS: The submedial cirral fold of *Anacanthorus beleophallus* is apparently homologous to the cirral "feather" characterizing a group of *Anacanthorus* species infesting serrasalmid hosts in the environs of Manaus, Brazil (compare Figs. 10, 60, 118, 122). Van Every and Kritsky (1992) consider *A. beleophallus* as the sister to this group of species (see fig. 70 in Van Every and Kritsky, 1992). It is easily distinguished from this species group by possessing a submedial fold on the cirrus and a sickle-shaped termination of the accessory piece. The specific name is from Greek (*beleos* = a dart + *phallos* = penis).

***Anacanthorus bellus* sp. n.**

(Figs. 14–16)

TYPE HOST AND LOCALITY: *Tripurtheus albus* Cope; Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORDS: *Tripurtheus elongatus* (Guenther), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989) and Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (6 January 1989); *Tripurtheus* sp., Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (1 November 1984).

TYPE SPECIMENS: Holotype, INPA PA351; paratypes, USNM 81670, 81671, 81672, 81673, HWML 33344.

DESCRIPTION (based on 24 specimens): Body 311 (233–389; $N = 12$) long, robust, fusiform; greatest width 82 (59–110; $N = 16$) near trunk midlength. Cephalic lobes large, well developed; anterior lobes fused along midline. Four eyes equidistant; members of posterior pair larger than those of anterior pair, 1 or both members of anterior pair poorly developed or occasionally absent; granules small, variable in shape; few accessory granules scattered in cephalic, anterior

trunk regions. Pharynx subspherical, 17 (14–21; $N = 17$) in diameter. Haptor 40 (33–50; $N = 12$) long, 49 (40–57; $N = 11$) wide. Hooks similar, each with truncate slightly depressed thumb, shank slightly expanded with small proximal enlargement; hook pairs 17 (16–18; $N = 36$) long; FH loop about 0.6 shank length. 4A's similar; each 8 ($N = 5$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 44 (30–53; $N = 9$) long, 34 (28–40; $N = 7$) wide; ovary 46 (33–67; $N = 8$) long, 30 (20–39; $N = 7$) wide. Cirrus, accessory piece articulated by copulatory ligament 5 (3–6; $N = 19$) long. Cirrus 56 (52–62; $N = 24$) long, sigmoid, with subterminal folds, large base lacking flange. Accessory piece 38 (35–42; $N = 24$) long, with 3 branches; longest branch terminally spatulate.

REMARKS: Based on the proximal portion of the accessory piece, the branches of the accessory piece, and haptor hooks, *Anacanthorus bellus* resembles *A. chelophorus* and *A. tricornis* spp. n. These species are easily differentiated by the comparative morphology of the cirral tip (with subterminal folds in *A. bellus*; flared in *A. chelophorus* and *A. tricornis*) and of the termination of the first branch of the accessory piece (long, spatulate in *A. bellus*; long, slightly flared in *A. chelophorus*; short, pointed in *A. tricornis*). The specific name is from Latin (*bellus* = neat, charming, handsome).

***Anacanthorus calophallus* sp. n.**

(Figs. 17–19)

TYPE HOST AND LOCALITY: *Tripurtheus elongatus* (Guenther); Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (22 November 1983, 6 January 1989).

OTHER RECORD: *Tripurtheus elongatus* (Guenther), Manaus Fish Market, Manaus, Amazonas, Brazil (10 March 1979).

TYPE SPECIMENS: Holotype, INPA PA352; paratypes, USNM 81674, 81675, HWML 33345.

DESCRIPTION (based on 11 specimens): Body 384 (288–476; $N = 7$) long, robust, fusiform; greatest width 114 (64–164; $N = 6$) at various levels along trunk, usually at level of copulatory complex. Cephalic lobes large, well developed. Two eyes; granules small, subovate to spherical; accessory granules absent or rare in cephalic, anterior trunk regions of adults, numerous throughout body in young specimens. Pharynx subspherical, 29 (22–36; $N = 7$) in diameter. Haptor 53 (47–60; $N = 6$) long, 77 (69–89; $N = 6$) wide.

Hooks similar; each with truncate thumb, slender shank with prominent proximal enlargement; hook 27 (26–29; $N = 29$) long; FH loop about 0.4 shank length. Dorsal 4A: 12–13 ($N = 3$) long, ventral 4A: 9 ($N = 1$) long; each proximally expanded about 0.5 length; dorsal 4A comparatively more robust. Gonads slightly overlapping; testis 79 (69–102; $N = 5$) long, 49 (39–59; $N = 4$) wide; ovary 52–53 ($N = 2$) long, 40 (33–46; $N = 2$) wide. Cirrus, accessory piece articulated; copulatory ligament apparently absent. Cirrus 41 (36–48; $N = 8$) long, comprising small base lacking flange, tight clockwise coil of 3.5 rings; outer surface of coil with keel; ring diameter 17 (16–20; $N = 9$). Accessory piece 34 (31–43; $N = 10$) long, comprising proximal shaft lying within cirral coil, terminal branches or plates, most distal with recurved point.

REMARKS: Relatively few species of *Anacanthorus* have been described with a coiled cirrus: *A. strongylophallus*, *A. mastigophallus*, *A. furculus* spp. n., and *A. spirallocirrus* Kritsky, Thatcher, and Kayton, 1979. The cirral coils of *A. spirallocirrus* and *A. mastigophallus* are counterclockwise and clearly represent different evolutionary states developed independently within the group. The clockwise coil of *A. calophallus* apparently represents a similar state to that found in *A. strongylophallus* and *A. furculus*. Based on hook structure, *A. calophallus* most closely resembles *A. furculus*, from which it differs by possessing a lateral keel along the cirral coil and by lacking a secondary accessory piece. The specific name is from Greek (*kalos* = beautiful + *phallos* = penis).

***Anacanthorus carinatus* sp. n.**

(Figs. 20–22)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA353; paratypes, USNM 81676, HWML 33346.

DESCRIPTION (based on 29 specimens): Body 564 (384–707; $N = 20$) long, robust, fusiform, gently tapered toward both ends from midlength; greatest width 130 (92–159; $N = 23$). Cephalic lobes large, well developed; anterior pair fused along midline. Four eyes equidistant; members of posterior pair larger than those of anterior pair; anterior pair absent or poorly developed; granules small to moderately large, variable in shape; accessory granules scattered in cephalic,

trunk regions. Pharynx subspherical or subovate, 30 (25–36; $N = 24$) in greatest width. Haptor 62 (45–71; $N = 20$) long, 89 (75–103; $N = 18$) wide. Hooks similar; each with depressed truncate thumb, conspicuously inflated shank tapering toward both bends; hook pairs variable in length, 34 (29–37; $N = 54$) long; FH loop about 0.3 shank length. 4A's similar; each 9–10 ($N = 4$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 68 (57–94; $N = 17$) long, 38 (26–53; $N = 17$) wide; ovary 69 (50–89; $N = 16$) long, 42 (30–59; $N = 16$) wide. Egg 63 ($N = 1$) long, 34 ($N = 1$) wide, subovate, with tapered anterior end, small proximal filament. Cirrus, accessory piece articulated by copulatory ligament 2–3 ($N = 14$) long. Cirrus 57 (53–64; $N = 21$) long, sigmoid, with subterminal spine or flare, large base with flange developed anteriorly to form secondary accessory piece; secondary accessory piece 57 (52–64; $N = 15$) long, with distal fingers supporting cirral tip. Primary accessory piece 42 (37–47; $N = 14$) long, with 2 blunt branches arising from short base.

REMARKS: Based on structure of the primary accessory piece, *Anacanthorus carinatus* resembles *A. euryphallus* sp. n. However, *A. euryphallus* lacks inflated hook shanks and a secondary accessory piece. *Anacanthorus carinatus* possesses hooks similar to those of *A. alatus*, *A. cornutus*, *A. lygophallus*, and *A. strongylophallus* spp. n., but is the only species in the genus with a secondary accessory piece developed from the cirral base. The specific name is from Latin (*carinatus* = keel formed) and refers to the development of the posterior margin of the cirral base.

***Anacanthorus catoprioni* sp. n.**

(Figs. 23–27)

TYPE HOST AND LOCALITY: *Catoprion mento* (Cuvier); Balbina, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (20 September 1985).

OTHER RECORD: *Catoprioni mento* (Cuvier), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA354; paratypes, USNM 81677, 81678, HWML 33347.

DESCRIPTION (based on 32 specimens): Body 294 (233–431; $N = 16$) long, fusiform, gently tapered toward both ends; greatest width 78 (59–111; $N = 15$) near midlength. Cephalic lobes moderately developed; anterior lobes fused along midline. Four eyes equidistant; members of pos-

terior pair larger than those of anterior pair; granules variable in size; ovate to elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 19 (14–26; $N = 13$) in diameter. Haptor 45 (34–60; $N = 12$) long, 75 (58–89; $N = 10$) wide. Hooks similar; each with truncate depressed thumb, shank proximally inflated 0.25 (pairs 1, 7), 0.3 (pairs 2, 5, 6), or 0.5 (pairs 3, 4) length; hook pairs 1, 2, 5–7: 19 (17–21; $N = 54$), pairs 3, 4: 25 (23–27; $N = 27$) long; FH loop about 0.5 shank length. 4A's similar; each proximally expanded about 0.5 length; ventral 4A: 11 (8–14; $N = 11$), dorsal 4A: 13 (11–14; $N = 7$) long. Gonads slightly overlapping; testis 33 (28–41; $N = 6$) long, 21 (19–25; $N = 6$) wide; ovary 31 (27–39; $N = 11$) long, 22 (17–28; $N = 8$) wide. Cirrus, accessory piece articulated; copulatory ligament absent. Cirrus 48 (41–54; $N = 21$) long, sigmoid, with terminal flare, base lacking flange. Accessory piece 29 (27–32; $N = 18$) long, with submedial truncate branch, subterminal flap.

REMARKS: Based on hook morphology, *Anacanthorus catoprioni* is related to the *Anacanthorus* complex infesting other piranha hosts (Boeger and Kritsky, 1988; Van Every and Kritsky, 1992; this study). However, it differs from these species by possessing a sigmoid cirrus and an accessory piece articulated to the cirral base. This species is named for its host.

Anacanthorus chaunophallus sp. n.

(Figs. 28–30)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA355; paratypes, USNM 81679, HWML 33348.

DESCRIPTION (based on 4 specimens): Body 341 (303–370; $N = 3$) long, slender, fusiform, gently tapered toward both ends; greatest width 70 (51–80; $N = 3$) near midlength. Cephalic lobes well developed; anterior lobes fused along midline. Four eyes equidistant; members of anterior pair infrequently absent, usually poorly developed, smaller than those of posterior pair; granules small, subspherical to elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 22 (19–24; $N = 3$) in diameter. Haptor 48 (46–50; $N = 3$) long, 56 (54–58; $N = 3$) wide. Hooks similar; each with broad truncate thumb, small proximal enlargement of slender shank; hook pairs 23 (22–

24; $N = 10$) long; FH loop about 0.6 shank length. 4A's similar; each 10–11 ($N = 3$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 37 (35–38; $N = 2$) long, 21 (17–24; $N = 2$) wide; ovary 39 (38–40; $N = 2$) long, 24 (20–27; $N = 2$) wide. Cirrus, accessory piece articulated by copulatory ligament 9–10 ($N = 4$) long. Cirrus 56 (53–59; $N = 4$) long, sigmoid, with terminal flare, lateral subterminal flaps, large base lacking flange. Accessory piece 37 (36–38; $N = 4$) long, with 3 branches; medial branch flattened distally.

REMARKS: *Anacanthorus chaunophallus* is similar to *A. bellus* sp. n. It differs from this species by the proximal branch of the accessory piece being reduced and by hooks having slender shanks. The specific name is from Greek (*chaunos* = bloated + *phallos* = penis).

Anacanthorus chelophorus sp. n.

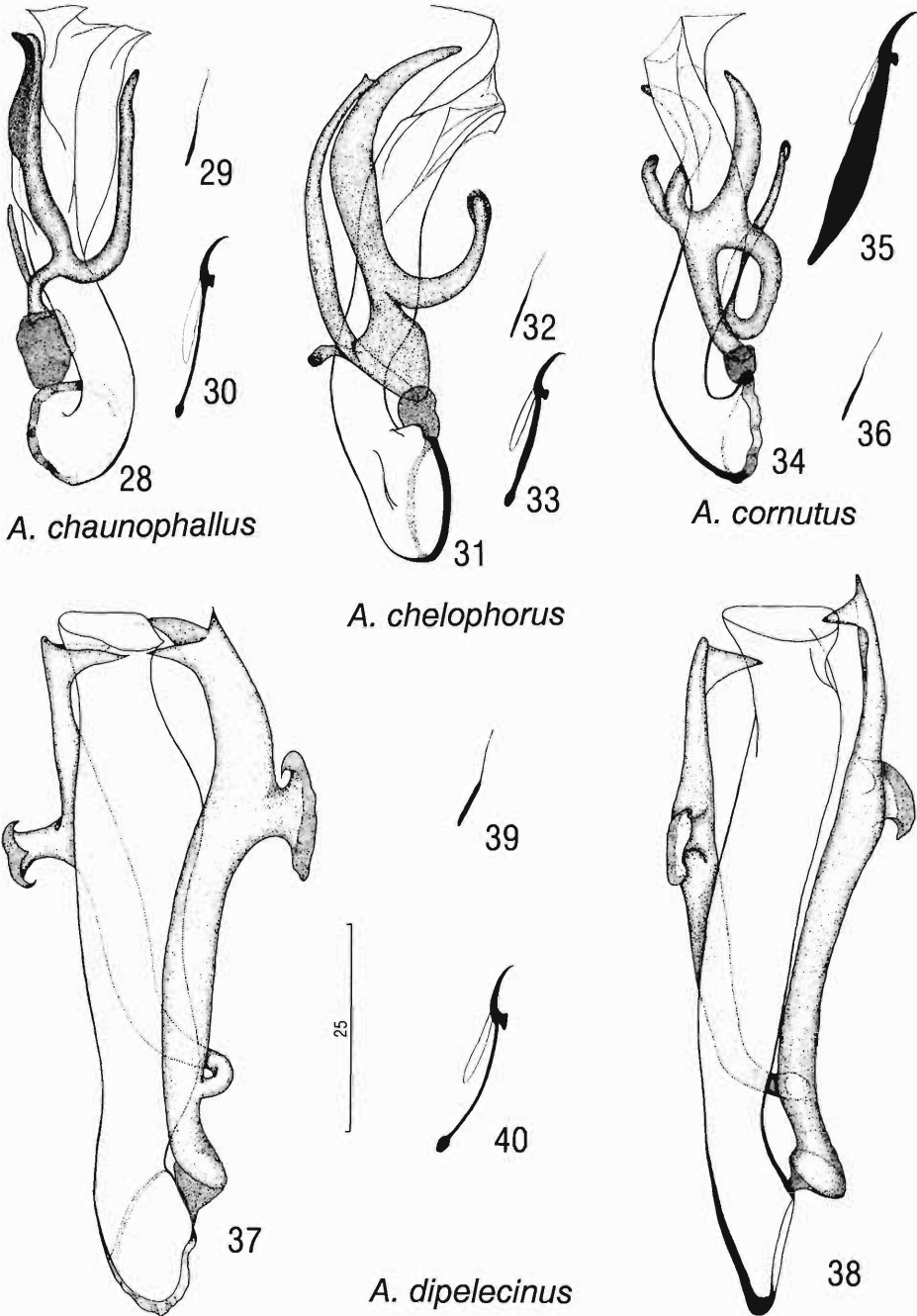
(Figs. 31–33)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

OTHER RECORDS: *Triportheus angulatus* (Spix), Furo do Catalão near Manaus, Amazonas, Brazil; *Triportheus* sp., Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (22 November 1983).

TYPE SPECIMENS: Holotype, INPA PA356; paratypes, USNM 81680, 81681, 81682, HWML 33349.

DESCRIPTION (based on 15 specimens): Body 412 (309–578; $N = 10$) long, variable, delicate to robust, fusiform, with short to elongate peduncle; greatest width 101 (62–129; $N = 11$) at various levels along trunk. Cephalic lobes large, well developed; anterior lobes frequently fused along midline. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules small, subovate to elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 21 (17–24; $N = 9$) in diameter. Haptor 50 (44–59; $N = 9$) long, 67 (53–87; $N = 9$) wide. Hooks similar; each with truncate slightly depressed thumb, slightly expanded shank with small proximal enlargement; hook pairs 19 (18–20; $N = 24$) long; FH loop about 0.5 shank length. 4A's similar; each 8–9 ($N = 3$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 51 (37–67; $N = 8$) long, 28 (23–33; $N = 8$) wide; ovary 55 (36–83; $N = 8$) long, 31 (23–47;



Figures 28–40. Sclerotized parts of *Anacanthorus* spp., continued. 28–30. *Anacanthorus chaunophallus*. 28. Copulatory complex. 29. 4A. 30. Hook. 31–33. *Anacanthorus chelophorus*. 31. Copulatory complex. 32. 4A. 33. Hook. 34–36. *Anacanthorus cornutus*. 34. Copulatory complex. 35. Hook. 36. 4A. 37–40. *Anacanthorus dipelecinus*. 37, 38. Two views of the copulatory complex. 39. 4A. 40. Hook. All figures are drawn to the 25- μ m scale.

$N = 8$) wide. Cirrus, accessory piece articulated by copulatory ligament 9 (8–10; $N = 9$) long. Cirrus 61 (53–71; $N = 14$) long, sigmoid, with terminal flare, large base lacking flange. Accessory piece 41 (37–44; $N = 13$) long, 4 branches; 2 branches forming claw.

REMARKS: *Anacanthorus chelophorus* resembles *A. glyptophallus* and *A. acuminatus* spp. n. based on the comparative morphology of the accessory piece and hooks. It differs from *A. glyptophallus* by lacking a second accessory piece and from *A. acuminatus* by possessing a large claw-shaped portion of the accessory piece. The specific name is from Greek (*chele* = claw + *phoros* = bearing).

***Anacanthorus cornutus* sp. n.**

(Figs. 34–36)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA357; paratypes, USNM 81683, HWML 33350.

DESCRIPTION (based on 10 specimens): Body 392 (324–438; $N = 6$) long, robust, noticeably flattened, foliform; trunk subovate in dorsoventral view; peduncle elongate; greatest width 153 (140–178; $N = 6$) at trunk midlength. Cephalic lobes large, well developed; anterior lobes fused along midline; additional small lobe on cephalic margin between bilateral lobes and cephalic tip. Four eyes equidistant; members of posterior pair larger than those of anterior pair, anterior pair absent or poorly developed; granules moderately large, elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx ovate to subspherical, 25 (24–26; $N = 6$) wide. Haptor 53 (41–59; $N = 6$) long, 69 (53–85; $N = 6$) wide. Hooks similar; each with slightly depressed truncate thumb; shank conspicuously inflated, gently tapering toward both ends; hook lengths variable, 31 (26–35; $N = 32$); FH loop about 0.3 shank length. 4A's similar; each 9–10 ($N = 5$) long, proximally expanded about 0.5 length. Gonads overlapping significantly; testis 39 (28–53; $N = 5$) long, 32 (22–39; $N = 5$) wide; ovary 58 (47–69; $N = 5$) long, 35 (21–46; $N = 6$) wide. Cirrus, accessory piece articulated by copulatory ligament 5–6 ($N = 10$) long. Cirrus 55 (50–58; $N = 10$) long, sigmoid, with subterminal spine or flare, large base lacking flange. Accessory piece 34 (33–36; $N = 9$) long, with 4 branches, 2 bladelike, 2 with blunt ends.

REMARKS: *Anacanthorus cornutus* resembles

A. alatus, *A. carinatus*, *A. lygophallus*, and *A. strongylophallus* spp. n. by possessing hooks with shanks inflated near midlength and tapered toward both ends. It is most similar to *A. alatus*, from which it differs by being larger and by possessing 2 bladelike branches of the accessory piece (1 in *A. alatus*). The specific name is from Latin (*cornutus* = horned) and refers to the accessory piece and its branches.

***Anacanthorus dipelecinus* sp. n.**

(Figs. 37–40)

TYPE HOST AND LOCALITY: *Roeboides myersii* Gill; Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (1 November 1984).

OTHER RECORD: *Roeboides myersii* Gill, Rio Negro near Manaus, Amazonas, Brazil (28 December 1988).

TYPE SPECIMENS: Holotype, INPA PA358; paratypes, USNM 81684, 81685, HWML 33351.

DESCRIPTION (based on 21 specimens): Body 440 (403–484; $N = 4$) long, robust, fusiform, gently tapered toward each end; greatest width 101 (85–108; $N = 9$) at midlength. Cephalic lobes moderately developed; anterior lobes fused along midline. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules variable in size, subovate; accessory granules few to numerous in cephalic region, or absent. Pharynx subspherical, 27 (23–31; $N = 8$) in diameter. Haptor 50 (43–66; $N = 5$) long, 71 (59–77; $N = 5$) wide. Hooks similar, each with truncate depressed thumb, small proximal enlargement of shank; hook pairs 25 (23–26; $N = 20$) long; FH loop about 0.5 shank length. 4A's similar; each 11 (10–12; $N = 7$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 41 (31–48; $N = 4$) long, 32 (28–36; $N = 4$) wide; ovary 41 (35–49; $N = 8$) long, 42 (35–50; $N = 9$) wide. Cirrus, accessory piece articulated by copulatory ligament 6 (5–8; $N = 13$) long. Cirrus 86 (75–101; $N = 15$) long, sigmoid, expanded, with terminal flare, large base lacking flange. Accessory piece 69 (62–75; $N = 13$) long, with 2 branches; each branch with submedial short flat branch, terminal spines.

REMARKS: *Anacanthorus dipelecinus* possesses characteristics of the haptor and copulatory complex similar to those of *Anacanthorus* species infesting *Triportheus angulatus*, *T. albus*, and *T. elongatus*. However, it is most similar to *A. cuticulovaginus* Kritsky and Thatcher, 1974, a parasite of *Salminus affinis*. It differs from this species by possessing a hatchetlike projection on

each arm of the accessory piece (*A. cuticulovaginus* possesses undifferentiated irregular margins of the accessory piece). The specific name is from Greek (*pelecy* = hatchet) and refers to the submedial branches of the accessory piece.

***Anacanthorus euryphallus* sp. n.**

(Figs. 41–43)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORDS: *Triportheus angulatus* (Spix), Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988); *T. elongatus* (Guenther), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989); *T. albus* Cope, Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA359; paratypes, USNM 81686, 81687, 81688, 81689, HWML 33352.

DESCRIPTION (based on 16 specimens): Body 309 (264–357; $N = 5$) long, fusiform or gently tapered anteriorly from level of testis; greatest width 67 (53–80; $N = 8$) near midlength or at testicular level. Cephalic lobes large, well developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair, 1 or both members of anterior pair poorly developed or absent; granules small, elongate ovate; accessory granules rare in cephalic region. Pharynx subspherical 15 (11–17; $N = 9$) in diameter. Haptor 39 (30–52; $N = 5$) long, 57 (54–60; $N = 6$) wide. Hooks similar; each with truncate thumb, robust shank, small proximal enlargement of shank; hook pairs 20 (19–23; $N = 49$) long; FH loop about 0.5 shank length. 4A's similar; each 7 ($N = 5$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 39 ($N = 2$) long, 23 (22–24; $N = 2$) wide; ovary 41 (40–42; $N = 4$) long, 25 (15–34; $N = 5$) wide. Cirrus, accessory piece articulated by copulatory ligament 2–3 ($N = 9$) long. Cirrus 31 (28–35; $N = 14$) long, broadly tubular, sigmoid, with slight terminal flare, base lacking flange. Accessory piece 26 (23–28; $N = 15$) long, with 2 branches; longer branch terminally bifid.

REMARKS: This species resembles *Anacanthorus carinatus* sp. n. in comparative morphology of the accessory piece. They differ most significantly by *A. euryphallus* lacking expanded hook shanks and a secondary accessory piece developed from the cirral base. The specific name

is from Greek (*eury*s = wide, broad + *phallos* = penis).

***Anacanthorus formosus* sp. n.**

(Figs. 44–46)

TYPE HOST AND LOCALITY: *Triportheus elongatus* (Guenther); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORD: *Triportheus* sp., Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (1 November 1984).

TYPE SPECIMENS: Holotype, INPA PA360; paratypes, USNM 81690, 81691, HWML 33353.

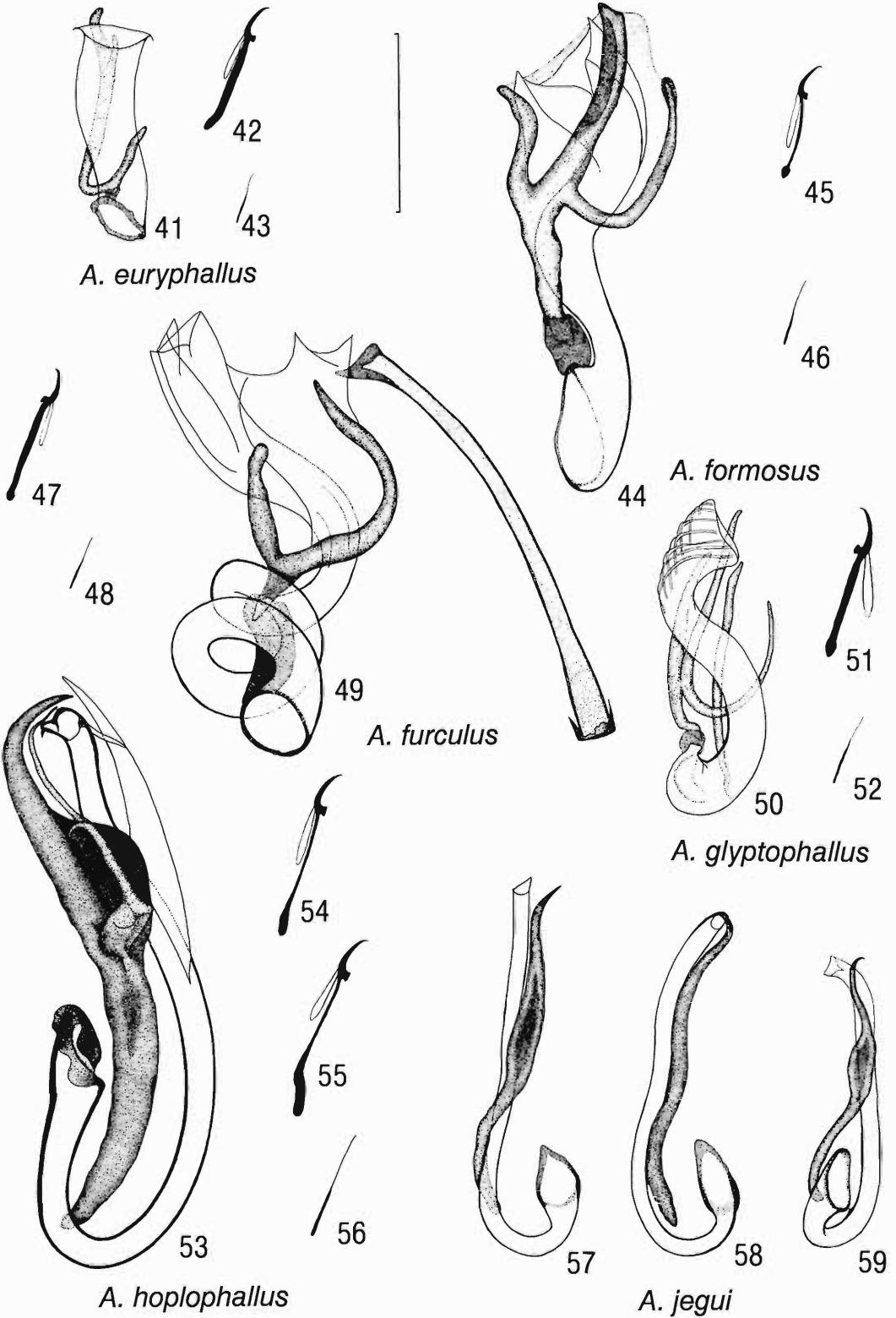
DESCRIPTION (based on 8 specimens): Body 295 (263–346; $N = 6$) long, fusiform, gently tapered toward both ends from midlength; greatest width 81 (62–100; $N = 7$). Cephalic lobes large, well developed; anterior lobes fused along midline. Four eyes equidistant; members of anterior pair poorly developed or absent, smaller than those of posterior pair; granules small, subovate; accessory granules absent or few in cephalic, anterior trunk regions. Pharynx subspherical, 16 (14–17; $N = 7$) in diameter. Haptor 45 (39–49; $N = 6$) long, 58 (48–71; $N = 5$) wide. Hooks similar; each with truncate thumb, slender shank with small proximal enlargement; hook pairs 18 (17–19; $N = 18$) long; FH loop about 0.6 shank length. 4A's similar; each 9–10 ($N = 4$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 36 (33–43; $N = 4$) long, 23 (18–26; $N = 4$) wide; ovary 39 (35–46; $N = 6$) long, 28 (20–38; $N = 6$) wide. Cirrus, accessory piece articulated by copulatory ligament 9 (8–10; $N = 7$) long. Cirrus 67 (62–72; $N = 8$) long, sigmoid, with terminal flare, large base lacking flange. Accessory piece 45 (41–47; $N = 8$) long, with long basal root, 3 blunt branches; central branch flattened.

REMARKS: Based on comparative morphology of the accessory piece, *Anacanthorus formosus* most closely resembles *A. cornutus* and *A. quinquemur* spp. n. It differs from *A. cornutus* by lacking an inflated hook shank and from *A. quinquemur* by lacking 2 small subterminal branches on the main accessory piece branches. The specific name is from Latin (*formosus* = beautiful).

***Anacanthorus furculus* sp. n.**

(Figs. 47–49)

TYPE HOST AND LOCALITY: *Triportheus elongatus* (Guenther); Rio Solimões near Manaus,



Amazonas, Brazil (22 November 1983, 6 January 1989).

OTHER RECORD: *Triportheus elongatus* (Guenther), Manaus Fish Market, Manaus, Amazonas, Brazil (10 March 1979).

TYPE SPECIMENS: Holotype, INPA PA361; paratypes, USNM 81692, 81693, HWML 33354.

DESCRIPTION (based on 38 specimens): Body 454 (290–584; $N = 22$) long, fusiform, with slight posterior taper from level of copulatory complex; greatest width 89 (52–140; $N = 26$). Cephalic lobes large, well developed, terminal lobes fused along midline. Two eyes, anterior pair absent; granules small, variable in shape, frequently ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 25 (17–29; $N = 24$) in diameter. Haptor 56 (40–71; $N = 21$) long, 70 (47–92; $N = 22$) wide. Hooks similar; each with truncate depressed thumb, shank slightly expanded with small proximal enlargement; hook pairs 19 (17–21; $N = 78$) long; FH loop about 0.5 shank length. 4A's similar; each 6 (5–7; $N = 3$) long, proximally expanded about 0.5 length. Gonads tandem or slightly overlapping; testis 84 (60–107; $N = 12$) long, 35 (30–40; $N = 12$) wide; ovary 36 (25–47; $N = 4$) long, 28 (18–32; $N = 4$) wide. Cirrus, primary accessory piece articulated by copulatory ligament 12 (10–14; $N = 25$) long. Cirrus 58 (46–76; $N = 29$) long, a clockwise coil of about 2.5 rings, with terminal membranous flare, base lacking flange; proximal ring diameter 21 (18–23; $N = 38$). Two accessory pieces; primary accessory piece 34 (28–45; $N = 17$) long, distally C shaped, comprised of 2 unequal branches. Secondary accessory piece 59 (49–69; $N = 28$), non-articulated to cirrus, appearing as straight tube spined distally with proximal circular base.

REMARKS: Only *Anacanthorus glyptophallus*, *A. carinatus*, and *A. furculus* spp. n. are known to possess 2 accessory pieces. Unlike that of *A. furculus*, however, the secondary accessory piece of *A. carinatus* is a development of the cirral base. *Anacanthorus furculus* differs from *A. glyptophallus* by having a coiled cirrus. A coiled cir-

rus is also a feature of *A. spirallocirrus* Kritsky, Thatcher, and Kayton, 1979, *A. strongylophallus*, *A. calophallus*, and *A. mastigophallus*. *Anacanthorus furculus* differs from these species in comparative morphology of the primary accessory piece and haptor hooks. The specific name is from Latin (*furcula* = small fork) and refers to the primary accessory piece.

***Anacanthorus glyptophallus* sp. n.**
(Figs. 50–52)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA362; paratypes, USNM 81694, HWML 33355.

DESCRIPTION (based on 36 specimens): Body 270 (228–320; $N = 22$) long, robust, fusiform; greatest width 82 (64–100; $N = 29$) near level of ovary or in posterior half. Cephalic lobes large, well developed; anterior lobes fused along midline. Four eyes; members of posterior pair larger, slightly closer together than members of anterior pair; granules small, ovate to elongate ovate; accessory granules uncommon in cephalic, anterior trunk regions. Pharynx subspherical, 16 (14–19; $N = 21$) in diameter. Haptor 41 (35–53; $N = 16$) long, 60 (50–70; $N = 20$) wide. Hooks similar; each with truncate thumb, heavy shank with small proximal enlargement; hook pairs 20 (19–21; $N = 44$) long; FH loop about 0.5 shank length. 4A's similar; each 8 ($N = 4$) long, proximally expanded about 0.6 length. Gonads slightly overlapping; testis 36 (26–46; $N = 10$) long, 25 (18–33; $N = 10$) wide; ovary 35 (26–49; $N = 15$) long, 26 (19–34; $N = 14$) wide. Seminal vesicle fusiform, with distal cork-screw configuration continuous with distal vas deferens. Cirrus, accessory piece articulated by copulatory ligament 4–5 ($N = 23$) long. Cirrus 41 (37–45; $N = 22$) long, sigmoid, with subterminal ridges, base lacking flange. Two accessory pieces; primary accessory piece 28 (24–31; $N = 21$) long, with 2 submedian branches articulating with primary branch at same point forming U-shaped structure; secondary ac-

← Figures 41–59. Sclerotized parts of *Anacanthorus* spp., continued. 41–43. *Anacanthorus euryphallus*. 41. Copulatory complex. 42. Hook. 43. 4A. 44–46. *Anacanthorus formosus*. 44. Copulatory complex. 45. Hook. 46. 4A. 47–49. *Anacanthorus furculus*. 47. Hook. 48. 4A. 49. Copulatory complex. 50–52. *Anacanthorus glyptophallus*. 50. Copulatory complex. 51. Hook. 52. 4A. 53–56. *Anacanthorus hoplophallus*. 53. Copulatory complex. 54. Hook pairs 1, 2, 5–7. 55. Hook pairs 3, 4. 56. 4A. 57–59. *Anacanthorus jegui*. 57, 58. Copulatory complexes of worms collected from *Serrasalmus spilopleura*. 59. Copulatory complex of worm collected from *Serrasalmus* sp. (2n = 58). All figures are drawn to the 25- μ m scale.

cessory piece 33 (30–34; $N = 6$) long, rod shaped, with pointed ends, not articulating to cirrus or primary accessory piece.

REMARKS: *Anacanthorus glyptophallus* and *A. furculus* spp. n. are the only species of the genus with 2 accessory pieces, 1 of which is non-articulated to the cirrus. These species are differentiated by the comparative morphology of the cirrus (sigmoid in *A. glyptophallus*, coiled in *A. furculus*). Based on the morphology of the primary accessory piece, *A. glyptophallus* resembles *A. acuminatus*. It differs from *A. acuminatus* by possessing ridges on the distal cirrus. In general, corresponding structures of the copulatory complex of *A. acuminatus* are more delicate than those of *A. glyptophallus*. The specific name is from Greek (*glyptos* = carved + *phallos* = penis) and refers to the cirral ridges.

***Anacanthorus hoplophallus* sp. n.**
(Figs. 53–56)

TYPE HOST AND LOCALITY: *Myliobatis rubripinnatus* (Mueller and Troschel); Nazare, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (10 September 1985).

TYPE SPECIMENS: Holotype, INPA PA363; paratypes, USNM 81695.

DESCRIPTION (based on 3 specimens): Body 379 (348–431; $N = 3$) long, fusiform, gently tapered toward both ends; greatest width 120 (73–150; $N = 3$) at midlength. Bilateral cephalic lobes reduced or absent; terminal lobes well developed, fused along midline. Four eyes equidistant; members of posterior pair much larger than those of anterior pair; granules small, subovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 19 ($N = 1$) in diameter. Haptor 49 (46–50; $N = 3$) long, 94 (79–108; $N = 3$) wide. Hooks similar; each with truncate thumb, shank with proximal enlargement about 0.2–0.3 shank length; hook pairs 1, 2, 5–7: 24 ($N = 2$), pairs 3, 4: 26–27 ($N = 4$) long; FH loop about 0.3–0.5 shank length. 4A's similar; each 11–12 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 36 ($N = 1$) long, 35 ($N = 1$) wide; ovary 39 ($N = 1$) long, 28 ($N = 1$) wide. Cirrus, accessory piece nonarticulated. Cirrus 81 (74–87; $N = 3$) long, J-shaped, with delicate pointed flap arising from distal half of cirral tube, small base lacking flange. Accessory piece 78 (74–81; $N = 3$) long, with recurved acute tip, submedial

keel, submedial branch with hairlike anterior extension.

REMARKS: The copulatory complex of *Anacanthorus hoplophallus* possesses features of some species infesting piranha (Van Every and Kritsky, 1992). The delicate flap arising from the midlength of the cirral shaft, the recurved lip of the cirrus, and the submedial branch of the pointed accessory piece suggest close relationship of this species to those on piranha. The specific name is from Greek (*hoplon* = tool, weapon + *phallos* = penis).

Anacanthorus jegui
Van Every and Kritsky, 1992
(Figs. 57–59)

HOSTS AND LOCALITIES: *Serrasalmus spilopleura* Kner, from Rio Solimões, Ilha da Marchantaria near Manaus, Amazonas, Brazil (14 September 1984, 26 November 1984) (USNM 81696, HWML 33356); *Serrasalmus* sp. (2 of Jégu), from Nazare, Rio Uatumã, Amazonas, Brazil (17 September 1985) (USNM 81697, HWML 33357), Rio Pitinga, Igarape Agua Branca, Rio Uatumã, Amazonas, Brazil (15 September 1985) (USNM 81698, HWML 33358), and Santa Luzia, Rio Uatumã, Amazonas, Brazil (20 September 1985) (USNM 81699); *Serrasalmus* sp. (2n = 58), from Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989) (USNM 81700, HWML 33359); *Pristobrycon eigenmanni* (Norman), from Santa Luzia, Rio Uatumã, Amazonas, Brazil (20 September 1985) (USNM 81701, HWML 33360), Nazare, Rio Uatumã, Amazonas, Brazil (17 September 1985) (USNM 81702, HWML 33361); *Pristobrycon* sp., from C. Miriti, Rio Uatumã, Amazonas, Brazil (26 September 1985) (USNM 81703).

REMARKS: *Anacanthorus jegui* was described from *Serrasalmus rhombeus* (Linnaeus) and characterized by double marginal expansions near the midlength of the accessory piece (Van Every and Kritsky, 1992). Morphologic variants, which we tentatively assign to *A. jegui*, have been found on other serrasalmid hosts. These variants differ primarily in the extent of the marginal expansions of the accessory piece (compare our Figs. 57–59 with figs. 24–26 in Van Every and Kritsky, 1992). Based on a comparatively high host specificity of the Dactylogyridea, it is possible that these populations comprise a species complex of closely related forms, each of which is associated with a particular serrasalmid host species.

***Anacanthorus lepyrophallus* sp. n.**
(Figs. 60–62)

TYPE HOST AND LOCALITY: *Serrasalmus elongatus* Kner; Rio Negro near Manaus, Amazonas, Brazil (28 December 1988).

OTHER RECORDS: *Serrasalmus* sp. (1 of Jégu), Rio Solimões near Ilha da Marchantaria near Manaus, Amazonas, Brazil (26 November 1984); *Serrasalmus* sp. (2n = 58), Lago do Rei, Paraná, Ilha do Careiro, Amazonas, Brazil (28 February 1986), and Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

SPECIMENS: Holotype, INPA PA364; paratypes, USNM 81704, HWML 33362; vouchers, USNM 81705, 81706, 81707.

DESCRIPTION (based on 39 specimens from *S. elongatus*): Body 412 (277–533; $N = 21$), fusiform, gently tapered toward both ends; greatest width 85 (70–101; $N = 21$) near midlength. Cephalic lobes well developed; anterior lobes fused medially. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules variable in size, ovate to elongate ovate; accessory granules scattered in cephalic, trunk regions. Pharynx subovate, 26 (22–35; $N = 25$) wide. Haptor 41 (33–49; $N = 15$) long, 72 (60–83; $N = 13$) wide. Hooks similar; each with short point, truncate depressed thumb, proximal enlargement of shank about 0.5 shank length; hook pairs 27 (24–31; $N = 44$) long; FH loop about 0.5 shank length. 4A's similar; each 14–15 ($N = 4$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 105 (41–167; $N = 10$) long, 33 (26–41; $N = 11$) wide; ovary 55 (36–70; $N = 18$) long, 25 (16–38; $N = 18$) wide. Cirrus, accessory piece nonarticulated. Cirrus 59 (52–67; $N = 28$) long, J-shaped, with subterminal aperture, submedial cirral "feather," base with small flange. Accessory piece 47 (43–55; $N = 24$) long, with sickle-shaped tip, small subterminal flap, indistinct submedial (muscle) articulation point.

REMARKS: The phylogenetic relationships of this species is provided by Van Every and Kritsky (1992). The above description is based only on specimens collected from *Serrasalmus elongatus*. However, specimens of *A. lepyrophallus* from other *Serrasalmus* species do not differ significantly in morphology; their measurements fall within ranges for corresponding values of *A. lepyrophallus* from the type host. The specific name is from Greek (*lepyron* = a husk + *phallos* =

penis) and refers to the featherlike appendage on the cirrus.

***Anacanthorus lygophallus* sp. n.**
(Figs. 63–65)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA365; paratypes, USNM 81708.

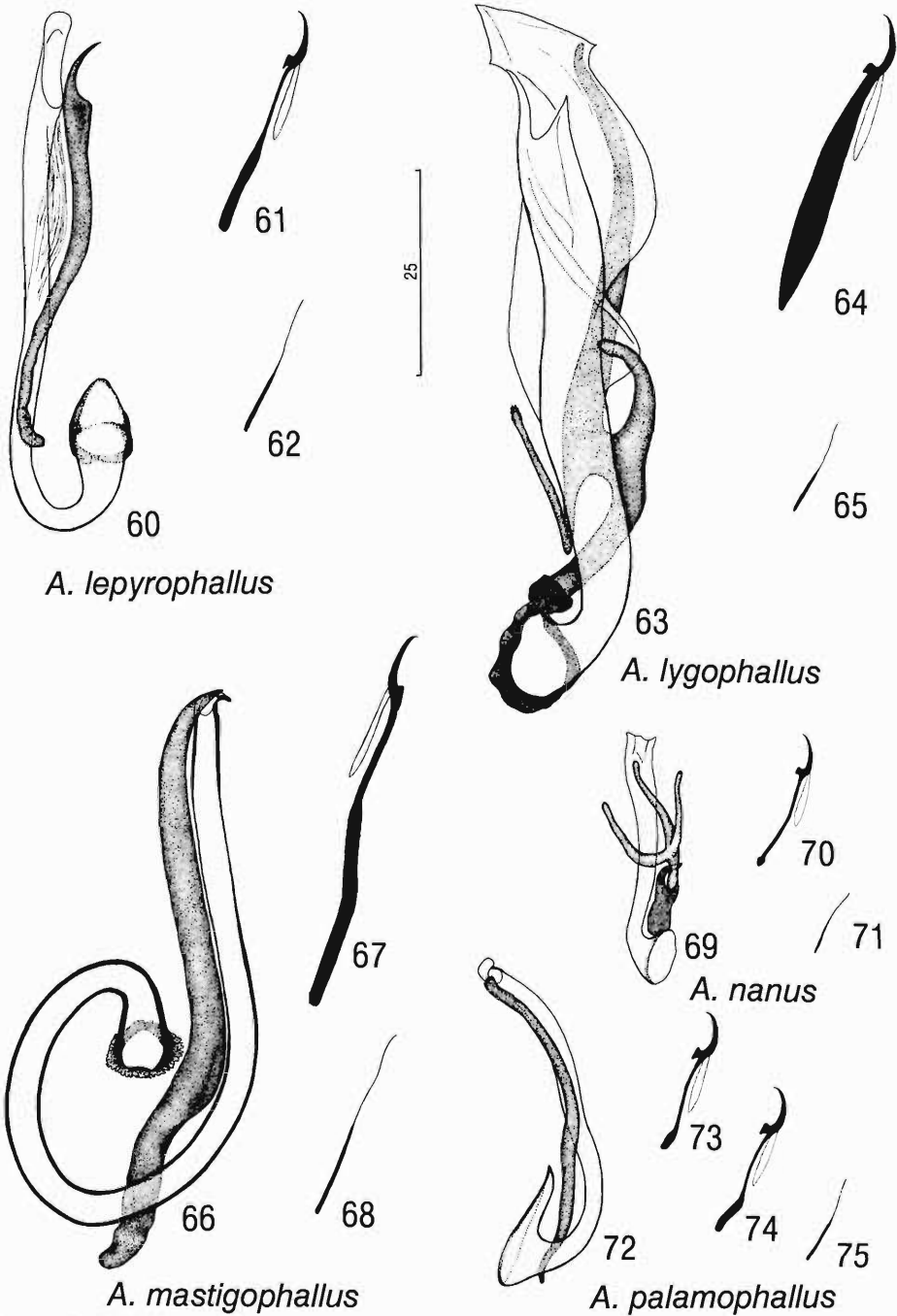
DESCRIPTION (based on 3 specimens): Body 531 ($N = 1$) long, robust; greatest width 132 ($N = 1$) in anterior trunk; peduncle moderately elongate. Cephalic lobes well developed. Two eyes, anterior pair absent; granules small, elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 24 ($N = 1$) in diameter. Haptor 62 ($N = 1$) long, 88 ($N = 1$) wide. Hooks similar; each with truncate thumb; shank conspicuously inflated, gently tapering toward both ends; hook pair 7 more robust, slightly larger than other pairs; hook pairs 35 (31–39; $N = 12$) long; FH loop about 0.3 shank length. 4A's similar; each 9 ($N = 1$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 33 ($N = 1$) long, 42 ($N = 1$) wide; ovary 58 ($N = 1$) long, 54 ($N = 1$) wide. Cirrus, accessory piece articulated by copulatory ligament 3–4 ($N = 3$) long. Cirrus 84 (79–87; $N = 3$) long, sigmoid, with subterminal flaps, terminal flare, large base lacking flange. Accessory piece 68 (64–72; $N = 3$) long, with long base, 3 branches; primary branch, 1 secondary branch separated from base by short lateral extension.

REMARKS: *Anacanthorus lygophallus* is likely the sister species of *A. cornutus* sp. n. based on morphology of the hooks and accessory piece. They differ by *A. lygophallus* having 3 branches of the accessory piece (4 in *A. cornutus*). The specific name is from Greek (*lygos* = twig + *phallos* = penis).

***Anacanthorus mastigophallus* sp. n.**
(Figs. 66–68)

TYPE HOST AND LOCALITY: *Pristobrycon eigenmanni* (Norman); Nazare, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (17 September 1985).

OTHER RECORD: *Pristobrycon eigenmanni* (Norman), Santa Luzia, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (20 September 1985).



Figures 60–75. Sclerotized parts of *Anacanthorus* spp., continued. 60–62. *Anacanthorus lepyrophallus*. 60. Copulatory complex. 61. Hook. 62. 4A. 63–65. *Anacanthorus lygophallus*. 63. Copulatory complex. 64. Hook. 65. 4A. 66–68. *Anacanthorus mastigophallus*. 66. Copulatory complex. 67. Hook. 68. 4A. 69–71. *Anacanthorus nanus*. 69. Copulatory complex. 70. Hook. 71. 4A. 72–75. *Anacanthorus palamophallus*. 72. Copulatory complex. 73. Hook pairs 1, 2, 5–7. 74. Hook pairs 3, 4. 75. 4A. All figures are drawn to the 25- μ m scale.

TYPE SPECIMENS: Holotype, INPA PA366; paratypes, USNM 81709, 81710, HWML 33363.

DESCRIPTION (based on 8 specimens): Body 584 (543–635; $N = 4$) long, robust, fusiform, gently tapered toward both ends; greatest width 170 (150–191; $N = 3$) near midlength. Cephalic lobes well developed. Four eyes; members of posterior pair larger, slightly farther apart than those of anterior pair; granules moderate in size, elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 40 (38–44; $N = 3$) in a diameter. Haptor 76 (70–88; $N = 3$) long, 95 (78–108; $N = 3$) wide. Hooks similar; each with flattened thumb, long proximal enlargement of shank; hook pairs 48 (46–53; $N = 13$) long; FH loop about 0.3 shank length. 4A's similar; each 18 (16–19; $N = 6$) long, proximally expanded about 0.5 length. Gonads slightly overlapping or tandem; testis 119 (95–144; $N = 2$) long, 66 (57–74; $N = 2$) wide; ovary 51 (46–56; $N = 2$) long, 49 (48–50; $N = 2$) wide. Cirrus, accessory piece nonarticulated. Cirrus 69 (66–72; $N = 6$) long, a counterclockwise coil of about 1 ring; base lacking flange, aperture directed posteriorly; ring diameter 30 (27–32; $N = 7$). Accessory piece 72 (69–75; $N = 5$) long, rod-shaped, with acute curved tip, small submedial flap; submedial (muscle) articulation point indistinct.

REMARKS: The phylogenetic relationships of this species is provided by Van Every and Kritsky (1992). The specific name is from Greek (*mastigos* = whip + *phallos* = penis) and refers to the shape of the cirrus.

Anacanthorus nanus sp. n.
(Figs. 69–71)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA367; paratypes, USNM 81711, HWML 33364.

DESCRIPTION (based on 14 specimens): Body 315 (263–390; $N = 9$) long, robust, fusiform, gently tapered toward both ends; peduncle poorly developed; greatest width 80 (66–93; $N = 11$) near midlength. Cephalic lobes well developed. Four eyes equidistant; members of anterior pair absent or poorly developed, smaller than those of posterior pair; granules small to moderate, elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 17 (15–18; $N = 9$) in diameter. Haptor

45 (36–52; $N = 9$) long, 53 (43–63; $N = 10$) wide. Hooks similar; each with truncate thumb, slender shank with small proximal enlargement; hook pairs 17–18 ($N = 15$) long; FH loop about 0.5 shank length. 4A's similar; each 7–8 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 41 (33–60; $N = 8$) long, 27 (21–36; $N = 8$) wide; ovary 55 (47–64; $N = 7$) long, 25 (18–30; $N = 7$) wide. Cirrus, accessory piece articulated by copulatory ligament 7–8 ($N = 12$) long. Cirrus 31 (29–34; $N = 8$) long, sigmoid, with small terminal flare, large base lacking flange. Accessory piece 18 (16–20; $N = 12$) long, with 3 subequal blunt branches; 2 lateral branches forming U-shape.

REMARKS: This species resembles *Anacanthorus formosus* sp. n. in morphology of the haptor hooks, accessory piece, and cirrus. The copulatory complex is significantly smaller and the 2 lateral branches of the accessory piece arise from the same level in *A. nanus*, whereas the lateral arms of the accessory piece in *A. formosus* originate at different levels along the main branch. The specific name is from Greek (*nannos* = dwarf) and refers to the small size of this worm.

Anacanthorus palamophallus sp. n.
(Figs. 72–75)

TYPE HOST AND LOCALITY: *Pristobrycon eigenmanni* (Norman); Nazare, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (17 September 1985).

OTHER RECORD: *Pristobrycon eigenmanni* (Norman), Santa Luzia, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (20 September 1985).

TYPE SPECIMENS: Holotype, INPA PA368; paratypes, USNM 81712, 81713, HWML 33365.

DESCRIPTION (based on 26 specimens): Body 313 (196–428; $N = 10$) long, fusiform, gently tapered from midlength toward both ends; greatest width 68 (45–94; $N = 14$). Cephalic lobes well developed. Four eyes; members of posterior pair larger, slightly closer together than those of anterior pair; granules small, elongate ovate; accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 17 (14–22; $N = 11$) in diameter. Haptor 41 (28–64; $N = 8$) long, 62 (48–72; $N = 7$) wide. Hooks similar; each with truncate slightly depressed thumb, shank proximally enlarged about 0.2–0.3 shank length; hook pairs 1, 2, 5–7: 18 (17–20; $N = 23$), pairs 3, 4: 19–20 ($N = 11$) long; FH loop about

0.5 shank length. 4A's similar; each 12 (11–13; $N = 8$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 45 (26–77; $N = 9$) long, 22 (16–26; $N = 9$) wide; ovary 35 (24–53; $N = 9$) long, 20 (16–26; $N = 9$) wide. Cirrus, accessory piece nonarticulated. Cirrus 46 (40–53; $N = 15$) long, C-shaped, with subterminal aperture, terminal flap, anteriorly acute base. Accessory piece 42 (36–48; $N = 11$) long, rod-shaped, with blunt tip, indistinct submedial (muscle) articulation point.

REMARKS: This species is sister to *Anacanthorus stachophallus* sp. n. and *Anacanthorus thatcheri* Boeger and Kritsky, 1988 (see Van Every and Kritsky, 1992). It differs from these species by lacking a knob on the cirral base and by possessing an unflared blunt tip of the accessory piece. The specific name is from Greek (*palame* = palm + *phallos* = penis).

***Anacanthorus paraspathulatus* sp. n.**
(Figs. 76–78)

TYPE HOST AND LOCALITY: *Mylossoma duriventris* (Cuvier); Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (6 January 1989).

TYPE SPECIMENS: Holotype, INPA PA369; paratypes, USNM 81714, HWML 33366.

DESCRIPTION (based on 7 specimens): Body 379 (328–446; $N = 6$) long, fusiform, gently tapered toward both ends; greatest width 69 (55–85; $N = 6$) at various levels along trunk. Cephalic lobes well developed. Four eyes; members of posterior pair larger, closer together than those of anterior pair; granules small, ovate; accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 22 (20–25; $N = 4$) in diameter. Haptor 49 (39–57; $N = 6$) long, 77 (70–82; $N = 6$) wide. Hooks similar; each with truncate depressed thumb, shank proximally enlarged about 0.3 length; hook pairs 26 (24–28; $N = 16$) long; FH loop about 0.5 shank length. 4A's similar; each 13–14 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 57 ($N = 1$) long, 16 ($N = 1$) wide; ovary 53 ($N = 1$) long, 13 ($N = 1$) wide. Cirrus, accessory piece articulated by copulatory ligament 4 ($N = 6$) long. Cirrus 37 (35–42; $N = 5$) long, sigmoid or C-shaped, with terminal flare, large base lacking flange. Accessory piece 22 (20–23; $N = 5$) long, with hooked tip, submedial branch or shelf.

REMARKS: *Anacanthorus paraspathulatus* is

similar to *A. spathulatus* Kritsky, Thatcher, and Kayton, 1979. Both species possess an accessory piece with a submedial shelf and hooks with depressed thumbs. The new species differs from *A. spathulatus* by having an acute termination of the accessory piece (spathulate in *A. spathulatus*). The specific name (*paraspathulatus*) reflects similarity of this species with *A. spathulatus*.

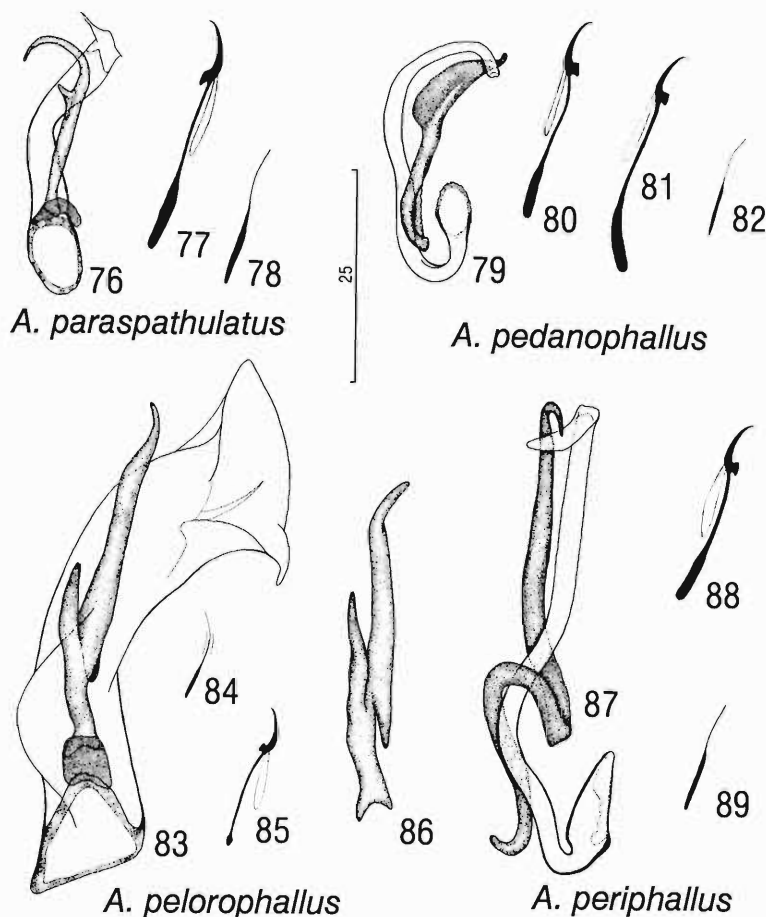
***Anacanthorus pedanophallus* sp. n.**
(Figs. 79–82)

TYPE HOST AND LOCALITY: *Myelus rubripinnus* (Mueller and Troschel); Nazare, Rio Uatumã, Amazonas, Brazil (10 September 1985).

TYPE SPECIMENS: Holotype, INPA PA370; paratypes, USNM 81715, HWML 33367.

DESCRIPTION (based on 19 specimens): Body 475 (369–577; $N = 8$) long, fusiform, gently tapered toward both ends; greatest width 90 (70–114; $N = 8$) at various levels along trunk. Bilateral cephalic lobes usually absent; terminal lobes well developed. Four eyes equidistant; members of posterior pair much larger than those of anterior pair; granules variable in size, ovate to elongate ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical to subovate, 23 (16–31; $N = 8$) wide. Haptor 53 (41–67; $N = 9$) long, 73 (66–83; $N = 9$) wide. Hooks similar; each with truncate slightly depressed thumb, proximally enlarged shank; hook pairs 1, 2, 5–7: 24 (22–26; $N = 21$), pairs 3, 4: 27 (25–28; $N = 14$) long; FH loop about 0.5 shank length. 4A's similar; each 13 (12–14; $N = 5$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 66 (41–81; $N = 7$) long, 26 (21–39; $N = 6$) wide; ovary 55 (42–60; $N = 8$) long, 24 (18–31; $N = 7$) wide. Cirrus, accessory piece nonarticulated. Cirrus 33 (25–49; $N = 13$) long, J-shaped with recurved termination, base lacking flange. Accessory piece 27 (21–32; $N = 12$) long, with subterminal tapered flap beginning near midlength.

REMARKS: *Anacanthorus pedanophallus* undoubtedly is related to the group of anacanthorine parasites infesting *Serrasalmus*, *Pristobrycon*, and *Pygocentrus* hosts (Boeger and Kritsky, 1988; Van Every and Kritsky, 1992; nobis) as shown by the common features of 1) a J-shaped cirrus, 2) nonarticulated cirrus and accessory piece, and 3) general morphology of the haptor hooks. It could most easily be confused with the nontype form of *A. reginae* Boeger and Kritsky, 1988, in that both possess recurved cirral tips and a sub-



Figures 76–89. Sclerotized parts of *Anacanthorus* spp., continued. 76–78. *Anacanthorus paraspathulatus*. 76. Copulatory complex. 77. Hook. 78. 4A. 79–82. *Anacanthorus pedanophallus*. 79. Copulatory complex. 80. Hook pairs 1, 2, 5–7. 81. Hook pairs 3, 4. 82. 4A. 83–86. *Anacanthorus pelorophallus*. 83. Copulatory complex. 84. 4A. 85. Hook. 86. Accessory piece. 87–89. *Anacanthorus periphallus*. 87. Copulatory complex. 88. Hook. 89. 4A. All figures are drawn to the 25- μ m scale.

terminal flap on the accessory piece. The specific name is from Greek (*pedanos* = short + *phallos* = penis).

***Anacanthorus pelorophallus* sp. n.**
(Figs. 83–86)

TYPE HOST AND LOCALITY: *Triportheus elongatus* (Guenther); Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (22 November 1983; 6 January 1989).

OTHER RECORD: *Triportheus elongatus* (Guenther), Manaus Fish Market, Manaus, Amazonas, Brazil (10 March 1979).

TYPE SPECIMENS: Holotype, INPA PA371; paratypes, USNM 81716, 81717, HWML 33368.

DESCRIPTION (based on 13 specimens): Body 407 (273–509; $N = 11$) long, fusiform, gently tapered toward both ends from midlength; greatest width 81 (69–104; $N = 11$). Cephalic lobes well developed. Four eyes equidistant; members of anterior pair absent or poorly developed, smaller than those of posterior pair; granules small, ovate; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 21 (14–26; $N = 12$) in diameter. Haptor 48 (36–59; $N = 8$) long, 58 (48–71; $N = 9$) wide. Hooks similar; each with truncate thumb, slender shank with small proximal enlargement; hook pairs 18 (17–19; $N = 26$) long; FH loop about 0.6 shank length. 4A's similar; each 9–10

($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 66 (55–83; $N = 8$) long, 37 (29–44; $N = 8$) wide; ovary 44 (35–59; $N = 4$) long, 26 (22–32; $N = 4$) wide. Cirrus, accessory piece articulated by copulatory ligament 5–6 ($N = 11$) long. Cirrus 64 (57–69; $N = 13$) long, sigmoid, expanded, with submedian hump, large terminal flare, large base lacking flange. Accessory piece 38 (34–42; $N = 13$) long, comprising 2 rods joined laterally at respective proximal, distal ends.

REMARKS: Based on morphology of the haptor hooks, *Anacanthorus pelorophallus* resembles *A. quinquerramus*, *A. calophallus*, *A. formosus*, *A. nanus*, and *A. chaunophallus* spp. n. It is distinguished from all of these by having a cirrus with a submedian “hump” and a relatively simple accessory piece. The specific name is from Greek (*peloros* = monstrous + *phallos* = penis).

***Anacanthorus periphallus* sp. n.**

(Figs. 87–89)

TYPE HOST AND LOCALITY: *Serrasalmus* sp. ($2n = 58$); Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORD: *Serrasalmus* sp. (1 of Jégu), Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (26 November 1984).

TYPE SPECIMENS: Holotype, INPA PA372; paratypes, USNM 81718, 81719, HWML 33369.

DESCRIPTION (based on 8 specimens): Body 318 (238–377; $N = 7$) long, robust, fusiform, gently tapered toward both ends; greatest width 106 (87–134; $N = 6$) near midlength. Cephalic lobes well developed. Four eyes; members of posterior pair larger, usually closer together than those of anterior pair; granules variable in size, irregular to elongate ovate; accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 24 (20–26; $N = 6$) in diameter. Haptor 47 (38–62, $N = 6$) long, 87 (65–107; $N = 6$) wide. Hooks similar; each with truncate slightly depressed thumb, shank proximally enlarged about 0.3 length; hook pairs 25 (22–28; $N = 21$) long; FH loop about 0.5 shank length. 4A's similar; each 12 (10–14; $N = 5$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 50 ($N = 1$) long, 28 ($N = 1$) wide; ovary 41 ($N = 1$) long, 27 ($N = 1$) wide. Cirrus, accessory piece nonarticulated. Cirrus 53 (47–57; $N = 8$) long, modified J-shape, with submedian bend, large base lacking flange, subterminal opening. Accessory piece 52 (45–55; $N =$

7) long, rod-shaped, wrapped around cirral shaft, terminally acute; submedian (muscle) articulation point indistinct.

REMARKS: Although *Anacanthorus periphallus* differs significantly from other *Anacanthorus* spp. infesting serrasalmid hosts by having the accessory piece wrapped around the cirral shaft, it clearly belongs to the large and complicated subgroup having J-shaped cirri with nonarticulating accessory pieces. Its phylogenetic relationships are provided by Van Every and Kritsky (1992). The specific name from Greek reflects the looping of the accessory piece around the cirrus (*peri* = around + *phallos* = penis).

***Anacanthorus pithophallus* sp. n.**

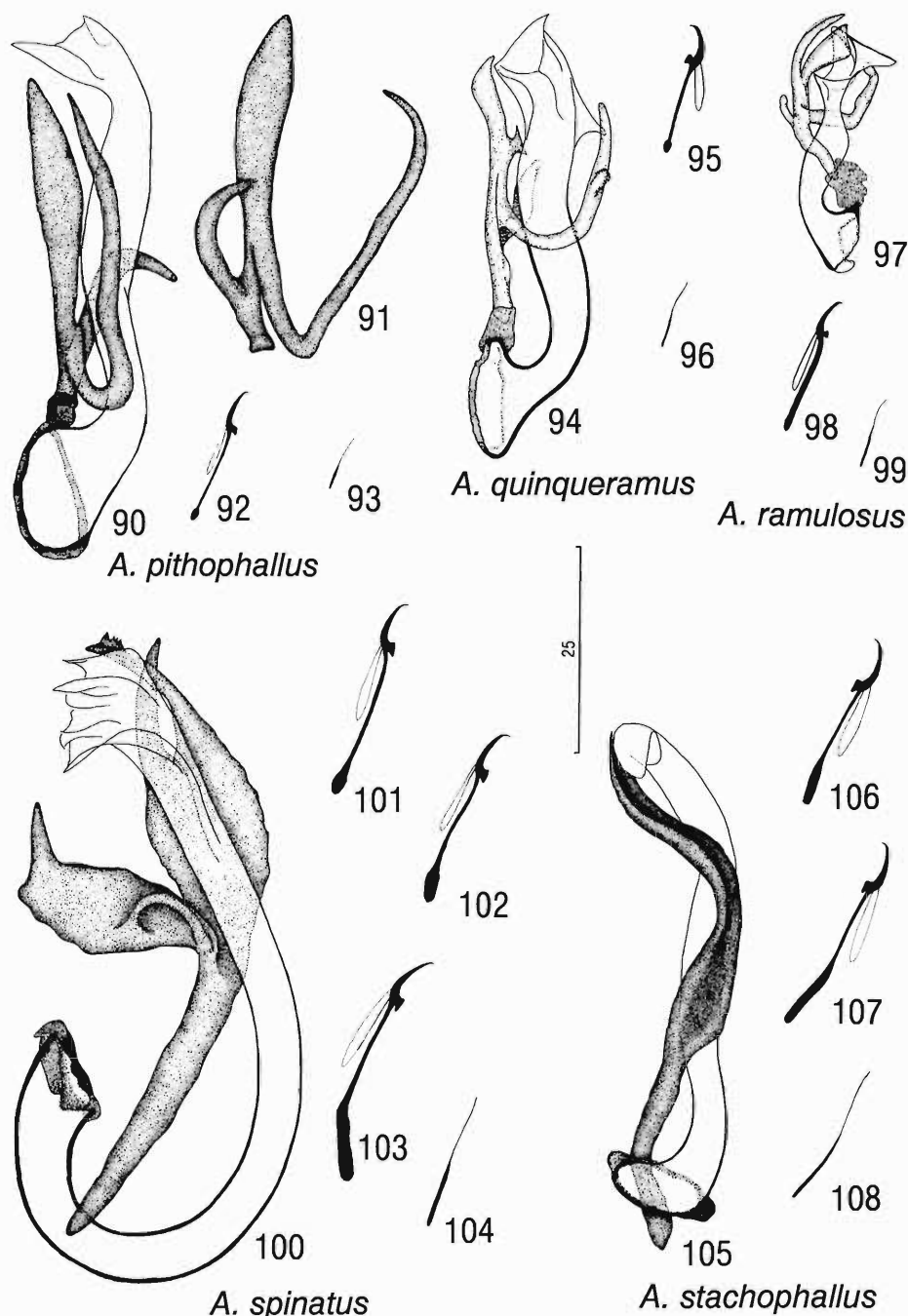
(Figs. 90–93)

TYPE HOST AND LOCALITY: *Triportheus angulatus* (Spix); Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988).

TYPE SPECIMENS: Holotype, INPA PA373; paratypes, USNM 81720, HWML 33370.

DESCRIPTION (based on 5 specimens): Body 267 (222–290; $N = 4$) long, robust, fusiform, gently tapered toward both ends; greatest width 85 (75–94; $N = 5$) at midlength. Cephalic lobes well developed. Four eyes equidistant; members of anterior pair slightly smaller than those of posterior pair; granules small, variable in shape; accessory granules apparently absent. Pharynx subspherical, 19 (17–21; $N = 5$) in diameter. Haptor 39 (33–43; $N = 5$) long, 58 (53–64; $N = 4$) wide. Hooks similar, each with truncate thumb, small proximal enlargement of slender shank; hook pairs 18 (17–19; $N = 12$) long; FH loop about 0.5 shank length. 4A's similar; each 6 ($N = 2$) long, proximally expanded about 0.5 length. Gonads slightly overlapping or tandem; testis 32 (24–39; $N = 4$) long, 26 (22–31; $N = 4$) wide; ovary 37 (28–42; $N = 5$) long, 31 (25–40; $N = 4$) wide. Cirrus, accessory piece articulated by copulatory ligament 3–4 ($N = 5$) long. Cirrus 63 (59–69; $N = 5$) long, sigmoid, with terminal flare, large base lacking flange. Accessory piece 39 (37–40; $N = 5$) long, with 3 branches, primary branch club-shaped.

REMARKS: This species resembles *Anacanthorus formosus* sp. n. in the general morphology of the accessory piece and cirrus. They differ most significantly by *A. pithophallus* having a comparatively shorter accessory piece base with a club-shaped primary branch. In addition, the lat-



Figures 90–108. Sclerotized parts of *Anacanthorus* spp., continued. 90–93. *Anacanthorus pithophallus*. 90. Copulatory complex. 91. Accessory piece. 92. Hook. 93. 4A. 94–96. *Anacanthorus quinqueramus*. 94. Copulatory complex. 95. Hook. 96. 4A. 97–99. *Anacanthorus ramulosus*. 97. Copulatory complex. 98. Hook. 99. 4A. 100–104. *Anacanthorus spinatus*. 100. Copulatory complex. 101. Hook pairs 1, 5–7. 102. Hook pair 2. 103. Hook pairs 3, 4. 104. 4A. 105–108. *Anacanthorus stachophallus*. 105. Copulatory complex. 106. Hook pairs 1, 2, 5–7. 107. Hook pairs 3, 4. 108. 4A. All figures are drawn to the 25-µm scale.

eral branch of the accessory piece is noticeably longer in *A. pithophallus*. The specific name is from Greek (*pithos* = a wide-mouth jar + *phallos* = penis).

***Anacanthorus quinquaramus* sp. n.**
(Figs. 94–96)

TYPE HOST AND LOCALITY: *Triportheus albus* Cope; Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORDS: *Triportheus elongatus* (Guenther), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989); *Triportheus* sp., Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (1 November 1984).

TYPE SPECIMENS: Holotype, INPA PA374; paratypes, USNM 81721, 81722, 81723, HWML 33371.

DESCRIPTION (based on 30 specimens): Body 288 (217–344; $N = 16$) long, robust, gently tapered posteriorly from level of copulatory complex; greatest width 92 (57–116; $N = 23$). Cephalic lobes well developed; anterior lobes fused along midline. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules small, variable in shape; few accessory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 21 (16–26; $N = 23$) in diameter. Haptor 37 (27–47; $N = 13$) long, 59 (50–74; $N = 13$) wide. Hooks similar; each with truncate thumb, small proximal enlargement of slender shank; hook pairs 16 (14–17; $N = 22$) long; FH loop about 0.5 shank length. 4A's similar; each 10 ($N = 3$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 37 (30–41; $N = 4$) long, 27 (25–29; $N = 3$) wide; ovary 28 (19–32; $N = 6$) long, 27 (23–33; $N = 6$) wide. Cirrus, accessory piece articulated by copulatory ligament 6 (5–8; $N = 28$) long. Cirrus 53 (48–57; $N = 19$) long, sigmoid, with subterminal spine, large conical base lacking flange. Accessory piece 33 (30–35; $N = 16$) long, with 5 branches.

REMARKS: *Anacanthorus quinquaramus* resembles *A. glyptophallus* and *A. chelophorus* spp. n. by having a U-shaped medial branch of the accessory piece. It differs from these species by having a total of 5 branches on the accessory piece and by having hooks with delicate shanks. The specific name is from Latin (*quinque* = five + *ramus* = branch) and refers to the accessory piece.

***Anacanthorus ramulosus* sp. n.**
(Figs. 97–99)

TYPE HOST AND LOCALITY: *Triportheus albus* Cope; Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

OTHER RECORDS: *Triportheus elongatus* (Guenther), Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA375; paratypes, USNM 81724, 81725, HWML 33372.

DESCRIPTION (based on 24 specimens): Body 210 (173–261; $N = 11$) long, robust, gently tapered anteriorly from level of testis; greatest width 64 (51–77; $N = 10$). Cephalic lobes well developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules small, elongate ovate; few to many accessory granules scattered throughout cephalic, trunk regions. Pharynx subspherical, 17 (15–19; $N = 9$) in diameter. Haptor 31 (29–35; $N = 10$) long, 56 (47–73; $N = 7$) wide. Hooks similar; each with truncate thumb, slightly inflated shank with small proximal enlargement; hook pairs 17–18 ($N = 36$) long; FH loop about 0.6 shank length. 4A's similar; each 7–8 ($N = 4$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 32 (29–33; $N = 4$) long, 22 (18–23; $N = 5$) wide; ovary 35 (25–45; $N = 7$) long, 23 (17–30; $N = 7$) wide. Cirrus, accessory piece articulated by copulatory ligament 8 (7–9; $N = 22$) long. Cirrus 33 (29–38; $N = 18$) long, sigmoid, with terminal flare, large base lacking flange. Accessory piece 22 (19–26; $N = 14$) long, with 4 branches; 1 medial branch "strong-arm"-shaped.

REMARKS: Based on the comparative morphology of the accessory piece and cirral base, this species resembles *Anacanthorus quinquaramus* and *A. formosus* spp. n. *Anacanthorus ramulosus* differs from *A. quinquaramus* by lacking a subterminal branch of the ventral medial arm of the accessory piece and by possessing slightly inflated hook shanks. It differs from *A. formosus* by the primary branch of the accessory piece being bifurcated into bluntly pointed and spatulate arms. The specific epithet is from Latin (*ramulosus* = full of small branches) and refers to the accessory piece.

***Anacanthorus spinatus* sp. n.**
(Figs. 100–104)

TYPE HOST AND LOCALITY: *Mylius rubripinnus* (Mueller and Troschel); Nazare, Rio Uatu-

mã, a tributary of Rio Amazonas, Amazonas, Brazil (10 September 1985).

TYPE SPECIMENS: Holotype, INPA PA376; paratypes, USNM 81726, HWML 33373.

DESCRIPTION (based on 12 specimens): Body 388 (274–668; $N = 10$) long, robust, fusiform, usually strongly contracted; greatest width 168 (108–229; $N = 10$) near midlength. Cephalic margin usually rounded, lobes poorly developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules small, irregular to elongate ovate; few accessory granules scattered in cephalic region. Pharynx subspherical, 27 (22–32; $N = 7$) in diameter. Haptor 59 (45–78; $N = 8$) long, 117 (92–157; $N = 9$) wide. Hooks similar; each with truncate slightly depressed thumb, shank with proximal enlargement varying in length with hook pair; hook pairs 1, 5–7: 25 (23–27; $N = 16$), pairs 2, 3, 4: 30 (29–32; $N = 13$) long; FH loop about 0.6 shank length. 4A's similar; each 15 (14–16; $N = 8$) long, proximally expanded about 0.5 length. Gonads slightly overlapping (all available specimens unstained). Cirrus, accessory piece nonarticulated. Cirrus 80 (77–87; $N = 9$) long, J-shaped, with terminal flare, base lacking flange. Accessory piece 70 (62–77; $N = 8$) long, with submedial bifurcation, branches terminally spined.

REMARKS: All available specimens of *Anacanthorus spinatus* were unstained and strongly contracted, both of which precluded reliable measurements of the reproductive organs. However, this species is distinct by having an accessory piece with 2 "antler-like" branches distally spined. It is apparently related to the group of species infesting Serrasalminae and characterized by possessing an accessory piece nonarticulated to the J-shaped cirrus. The specific name is from Latin (*spinatus* = spined) and refers to the accessory piece.

***Anacanthorus stachophallus* sp. n.**
(Figs. 105–108)

SYNONYM: *Anacanthorus* sp. (of Boeger and Kritsky, 1988).

TYPE HOST AND LOCALITY: *Pygocentrus nattereri* Kner; Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (15 August 1984; 6, 25, 27 November 1984).

OTHER RECORD: *Pygocentrus nattereri* Kner, Furo do Catalão near Manaus, Amazonas, Brazil (27 November 1984).

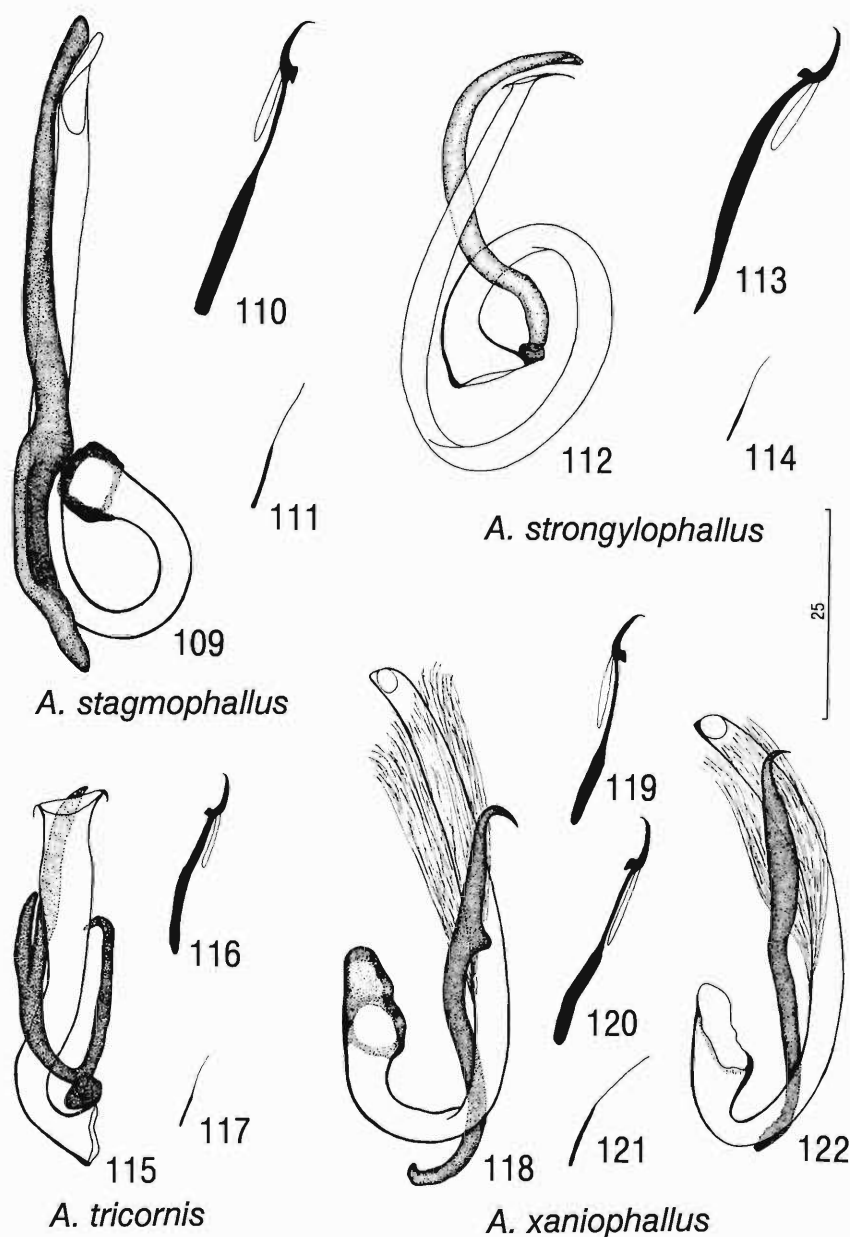
TYPE SPECIMENS: Holotype, INPA PA377; paratypes, USNM 79197, 81727, HWML 23371.

DESCRIPTION (based on 7 specimens): Body 564 (466–655; $N = 7$) long, fusiform, gently tapered toward both ends from midlength; greatest width 163 (118–195; $N = 6$). Cephalic lobes well developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules variable in size, elongate ovate; accessory granules absent to many in cephalic, anterior trunk regions. Pharynx subspherical, 36 ($N = 1$) in diameter. Haptor 73 (52–91; $N = 4$) long, 111 (84–136; $N = 4$) wide. Hooks similar; each with truncate slightly depressed thumb, shank enlarged proximally 0.3–0.5 shank length; hook pairs 1, 2, 5–7: 22 (21–23; $N = 6$), pairs 3, 4: 25 (24–26; $N = 5$) long; FH loop about 0.5 shank length. 4A's similar; each 13–14 ($N = 3$) long, proximally expanded about 0.5 length. Gonads slightly overlapping, indistinct. Cirrus, accessory piece nonarticulated. Cirrus 58 (54–65; $N = 7$) long, C-shaped, with subterminal aperture, large base having small proximal knob. Accessory piece 59 (50–65; $N = 7$) long, rod-shaped, with flared distal end, submedial (muscle) articulation point indistinct.

REMARKS: All available specimens of *Anacanthorus stachophallus* were unstained and mounted in Gray and Wess' medium which tend to flatten the specimens. As a result, measurements of soft body parts, including the body length and width, may not be totally comparable with measurements of other species described herein. However, *A. stachophallus*, recognized by Boeger and Kritsky (1988) as an undescribed species, is easily distinguished by the morphology of the copulatory complex. It is sister species to *A. thatcheri* Boeger and Kritsky, 1988, and *A. palamophallus* sp. n., from which it differs in the comparative morphology of the accessory piece. *Anacanthorus stachophallus* exhibits a basal to diagonal opening at the proximal end of the cirrus, whereas that exhibited by the other 2 species is lateral (Van Every and Kritsky, 1992). The specific epithet is from Greek (*stachys* = a spike + *phallos* = penis).

***Anacanthorus stagmophallus* sp. n.**
(Figs. 109–111)

TYPE HOST AND LOCALITY: *Myleus rubripinnus* (Mueller and Troschel); Nazare, Rio Uatuma, a tributary of Rio Amazonas, Amazonas, Brazil (10 September 1985).



Figures 109–122. Sclerotized parts of *Anacanthorus* spp., continued. 109–111. *Anacanthorus stigmophallus*. 109. Copulatory complex. 110. Hook. 111. 4A. 112–114. *Anacanthorus stronglylophallus*. 112. Copulatory complex. 113. Hook. 114. 4A. 115–117. *Anacanthorus tricornis*. 115. Copulatory complex. 116. Hook. 117. 4A. 118–122. *Anacanthorus xaniophallus*. 118. Copulatory complex of worm collected from *Pristobrycon* sp. from the Rio Uatumã. 119. Hook pairs 1, 2, 5–7. 120. Hook pairs 3, 4. 121. 4A. 122. Copulatory complex (typical) of worm collected from *Pristobrycon eigenmanni*. All figures are drawn to the 25- μ m scale.

TYPE SPECIMENS: Holotype, INPA PA378; paratypes, USNM 81728, HWML 33375.

DESCRIPTION (based on 12 specimens): Body 496 (311–657; $N = 6$) long, fusiform, gently tapered from midlength toward both ends; greatest

width 92 (78–123; $N = 6$). Cephalic lobes well developed; anterior lobes fused along midline. Four eyes equidistant; members of posterior pair much larger than those of anterior pair; granules small, subovate to elongate ovate; few accessory

granules scattered in cephalic, anterior trunk regions. Pharynx ovate, 25 (21–27; $N = 6$) wide. Haptor 65 (50–76; $N = 6$) long, 72 (61–88; $N = 4$) wide. Hooks similar; each with truncate slightly depressed thumb, shank with proximal enlargement about 0.5 total length; hook pairs 41 (35–48; $N = 43$) long; FH loop about 0.3 shank length. 4A's similar; each 14–15 ($N = 7$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 84 (63–96; $N = 4$) long, 21 (17–27; $N = 4$) wide; ovary 69 (55–89; $N = 5$) long, 26 (23–30; $N = 5$) wide. Cirrus, accessory piece nonarticulated. Cirrus 70 (64–76; $N = 7$) long, J-shaped, with subterminal aperture, small base lacking flange. Accessory piece 74 (62–80; $N = 6$) long, rodshaped with blunt distal end.

REMARKS: This species resembles *Anacanthorus palamophallus* sp. n. by possessing a simple rod-shaped accessory piece with blunt termination. They differ in the cirrus of *A. stigmaphallus* being in the shape of a "J", whereas that of *A. palamophallus* has a lateral basal opening. The specific name is from Greek (*stigmaphallos* = a drop + *phallos* = penis).

***Anacanthorus strongylophallus* sp. n.**

(Figs. 112–114)

TYPE HOST AND LOCALITY: *Triporthus elongatus* (Guenther); Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (22 November 1983; 6 January 1989).

OTHER RECORD: *Triporthus elongatus* (Guenther), Manaus Fish Market, Manaus, Amazonas, Brazil (10 March 1979).

TYPE SPECIMENS: Holotype, INPA PA379; paratypes, USNM 81729, 81730, HWML 33376.

DESCRIPTION (based on 11 specimens): Body 326 (243–407; $N = 6$) long, fusiform; greatest width 81 (75–94; $N = 6$) near midlength. Cephalic lobes well developed. Two eyes; granules small, subovate or irregular; accessory granules absent or rare in older specimens, scattered throughout trunk, cephalic regions in younger specimens. Pharynx subspherical, 21 (16–25; $N = 7$) in diameter. Haptor 45 (35–56; $N = 7$) long, 58 (51–64; $N = 7$) wide. Hooks similar; each with truncate thumb, conspicuously inflated shank gently tapered anteriorly, posteriorly from midlength, proximally pointed; hook pairs 34 (31–39; $N = 26$) long; FH loop about 0.3 shank length. 4A's similar; each 8 ($N = 3$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 57 (55–61; $N = 4$) long, 33 (29–

36; $N = 4$) wide; ovary 46 (41–53; $N = 4$) long, 26 (20–33; $N = 4$) wide. Cirrus, accessory piece articulated by copulatory ligament 4–5 ($N = 10$) long. Cirrus 115 (98–143; $N = 10$) long, a clockwise coil of 1.5 rings, with small base lacking flange; ring diameter 32 (28–36; $N = 11$). Accessory piece 38 (33–42; $N = 11$) long, curved, rod-shaped, with blunt tip.

REMARKS: Based on hook morphology, *Anacanthorus strongylophallus* resembles the following species infesting *Triporthus*: *A. alatus*, *A. carinatus*, *A. cornutus*, and *A. lygophallus* spp. n. It differs from all of these species by possessing a single rod-shaped accessory piece and a coiled cirrus. It superficially resembles *A. mastigophallus* from *Pristobrycon eigenmanni* (Serrasalmidae), which also possesses a coiled cirrus and rod-shaped accessory piece. However, the coiled states of these 2 species apparently represent homoplasies; that of *A. strongylophallus* being derived from the sigmoid state found in most other *Anacanthorus* species from *Triporthus*, and that of *A. mastigophallus* being derived from the J-shaped cirrus of *Anacanthorus* species found on serrasalmid hosts in the region (Van Every and Kritsky, 1992). Similarly, the "rod-shaped" states of the accessory pieces of these species likely are homoplasies with different origins. The specific name is from Greek (*strongylos* = rounded + *phallos* = penis).

***Anacanthorus tricornis* sp. n.**

(Figs. 115–117)

TYPE HOST AND LOCALITY: *Triporthus elongatus* (Guenther); Rio Solimões near Ilha da Marchantaria, Manaus, Amazonas, Brazil (22 November 1983; 6 January 1989).

OTHER RECORDS: *Triporthus elongatus* (Guenther), Manaus Fish Market, Manaus, Amazonas, Brazil (10 March 1979); *T. angulatus* (Spix), Bairro de São Jorge, Manaus, Amazonas, Brazil (31 December 1988) and Furo do Catalão near Manaus, Amazonas, Brazil (5 January 1989).

TYPE SPECIMENS: Holotype, INPA PA380; paratypes, USNM 81731, 81732, 81733, 81734, HWML 33377.

DESCRIPTION (based on 9 specimens): Body 314 (240–355; $N = 6$) long, fusiform, gently tapered from midlength toward each end; greatest width 83 (59–115; $N = 5$). Cephalic lobes well developed. Four eyes equidistant; members of anterior pair frequently absent or poorly developed, farther apart than those of posterior pair; granules moderately large, subovate; few acces-

sory granules scattered in cephalic, anterior trunk regions. Pharynx subspherical, 19 (17–21; $N = 4$) in diameter. Haptor 41 (31–59; $N = 4$) long, 62 (48–82; $N = 5$) wide. Hooks similar; each with truncate thumb, slightly inflated shank with indistinct proximal enlargement; hook pairs 21 (19–24; $N = 28$) long; FH loop about 0.3 shank length. 4A's similar; each 8–9 ($N = 5$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 36 (33–38; $N = 2$) long, 23 (20–27; $N = 2$) wide; ovary 44 (26–69; $N = 3$) long, 29 (14–54; $N = 3$) wide. Cirrus, accessory piece articulated by copulatory ligament 4–5 ($N = 8$) long. Cirrus 48 (44–54; $N = 9$) long, sigmoid, with terminal flare, base lacking flange. Accessory piece 38 (34–46; $N = 8$) long, with 3 blunt branches.

REMARKS: Based on the comparative morphology of the accessory piece and haptor hooks, *Anacanthorus tricornis* resembles *A. bellus* and *A. acuminatus* spp. n. It differs from *A. bellus* by having a comparatively short nonbifurcated branch of the accessory piece and from *A. acuminatus* by the blunt terminations of all accessory piece branches. The specific name is from Latin (*tri* = three + *cornu* = horn) and refers to the 3 branches of the accessory piece.

***Anacanthorus xaniophallus* sp. n.**
(Figs. 118–122)

TYPE HOST AND LOCALITY: *Pristobrycon eigenmanni* (Norman); Nazare, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (17 September 1985).

OTHER RECORDS: *Pristobrycon eigenmanni* (Norman), Santa Luzia, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (20 September 1985); *Pristobrycon* sp. n., C. Miriti, Rio Uatumã, a tributary of Rio Amazonas, Amazonas, Brazil (26 September 1985), Rio Negro near Manaus, Amazonas, Brazil (28 December 1988).

SPECIMENS: Holotype, INPA PA381; paratypes, USNM 81737, 81738, HWML 33378; vouchers, USNM 81735, 81736.

DESCRIPTION (based on 92 specimens from *P. eigenmanni*; 70 measured): Body 481 (341–696; $N = 19$) long, fusiform, gently tapered from midlength toward both ends; greatest width 81 (57–106; $N = 25$). Cephalic lobes well developed. Four eyes equidistant; members of posterior pair larger than those of anterior pair; granules variable in size, ovate to elongate ovate; usually few accessory granules scattered in cephalic, anterior

trunk regions. Pharynx subspherical to subovate, 22 (15–27; $N = 29$) wide. Haptor 62 (46–82; $N = 14$) long, 79 (55–100; $N = 15$) wide. Hooks similar; each with truncate slightly depressed thumb, shank proximally enlarged about 0.5 length; hook pairs 1, 2, 5–7: 26 (22–31; $N = 63$), pairs 3, 4: 29 (26–34; $N = 39$) long; FH loop about 0.5 shank length. 4A's similar; each 15 (13–16; $N = 18$) long, proximally expanded about 0.5 length. Gonads slightly overlapping; testis 69 (44–105; $N = 13$) long, 25 (16–39; $N = 13$) wide; ovary 63 (48–109; $N = 16$) long, 23 (16–34; $N = 16$) wide. Cirrus, accessory piece nonarticulated. Cirrus 53 (49–60; $N = 43$) long, J-shaped, with featherlike sheath arising from midlength of cirral shaft, base with lateral flange. Accessory piece 44 (38–48; $N = 44$) long, rod-shaped with terminal recurved point, variably developed submedial (muscle) articulation point.

REMARKS: The phylogenetic relationships of *Anacanthorus xaniophallus* are provided by Van Every and Kritsky (1992). The specific name is from Greek (*xanion* = a comb + *phallos* = penis) and refers to the featherlike sheath on the cirrus.

In addition to the type host, *A. xaniophallus* was collected from an undescribed species of *Pristobrycon* from the Rio Negro and Rio Uatumã. Specimens of *A. xaniophallus* from this host in the Rio Uatumã possess a distinct submedial (muscle) articulation point on the accessory piece (Fig. 118), while specimens from *P. eigenmanni* from the Rio Uatumã and *Pristobrycon* sp. from the Rio Negro have a small to indistinct point (Fig. 122). Measurements of the 3 populations do not differ significantly from one another.

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